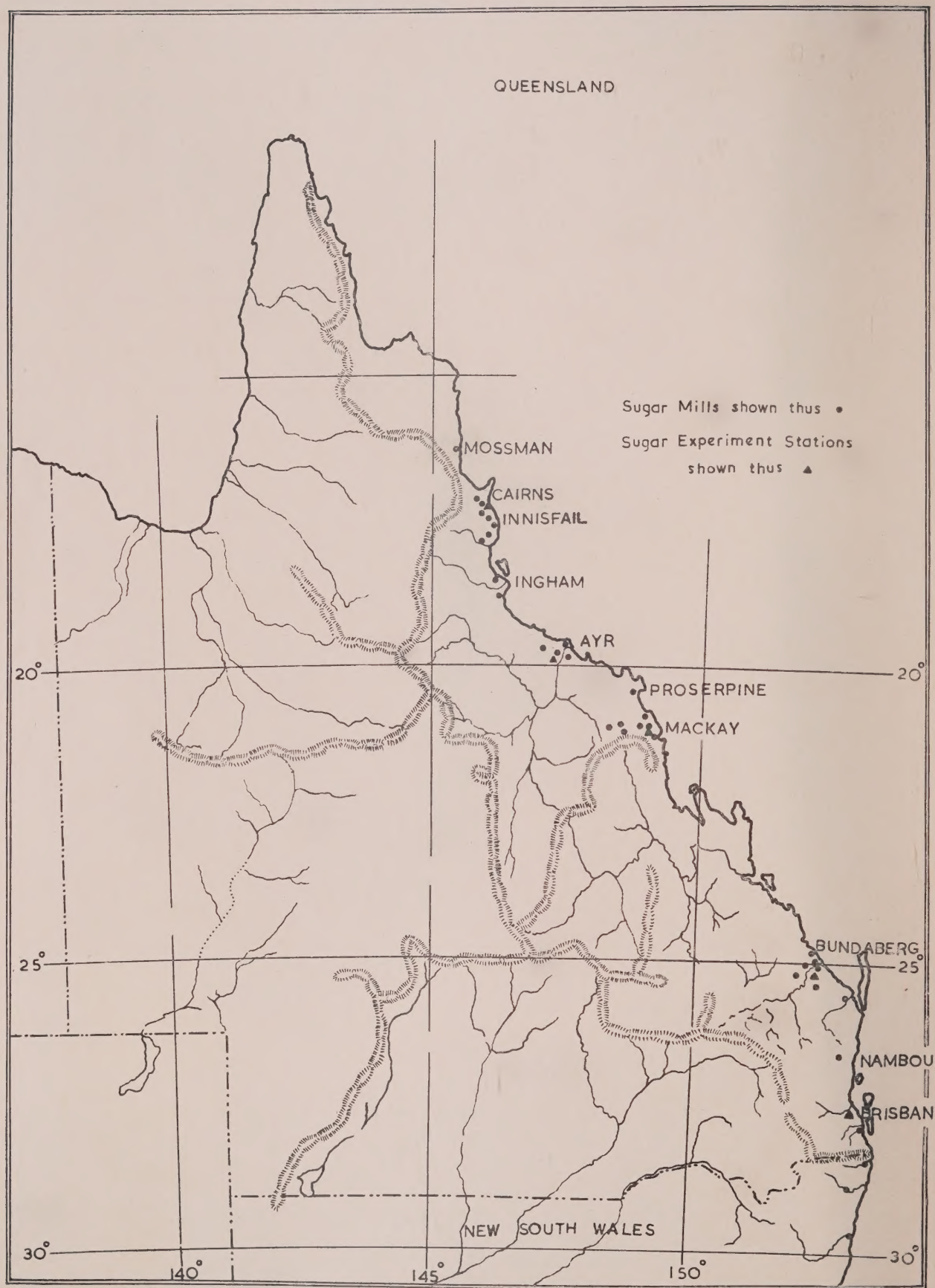
56th ANNUAL REPORT

BUREAU OF SUGAR EXPERIMENT STATIONS

QUEENSLAND

COMMONWEALTH MYCOLOGICAL INSTITUTE
2 JAN 195


QUEENSLAND
Sugar Mills shown thus •
Sugar Experiment Stations shown thus ▲
MOSSMAN
CAIRNS
INNISFAIL
INGHAM
AYR
PROSERPINE
MACKAY
BUNDABERG
NAMBOUR
BRISBANE
NEW SOUTH WALES
20°
25°
30°
140°
145°
150°

1956

QUEENSLAND

FIFTY-SIXTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS

REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

(As required by "The Sugar Experiment Stations Acts, 1900 to 1954")

BRISBANE

SUGAR EXPERIMENT STATIONS BOARD

The Hon. H. H. COLLINS, M.L.A., Minister for Agriculture and Stock, Chairman.
Mr. A. F. BELL, Under Secretary for Agriculture and Stock, Deputy Chairman.
Mr. J. W. INVERARITY, representing the manufacturers of cane sugar.
Mr. L. G. SCOTNEY, representing the growers of sugar cane.

BUREAU OF SUGAR EXPERIMENT STATIONS

NORMAN J. KING, Director.
L. G. VALLANCE, Asst. Director.
R. W. MUNGOMERY, Asst. to Director.

Head Office Staff:

C. G. HUGHES, Senior Pathologist (I).
D. R. L. STEINDL, Senior Pathologist (II).
O. W. STURGESS, Pathologist (II).
B. T. EGAN, Asst. Pathologist.

J. H. NICKLIN, Chief Technologist (Engr.).
L. R. BRAIN, Senior Mill Technologist (II).
A. D. DOOLAN, Asst. Mill Technologist.
J. D. WATSON, Technical Officer (II).

G. C. BIESKE, Chemist.
K. C. LEVERINGTON, Chemist.
J. M. SEDL, Asst. to Analysts.
J. R. BURGE, Asst. to Analysts.
F. SHORT, Lab. Attendant.

C. C. HORNE, Secretary.
A. D. BEAL, Asst. Accountant.
S. C. LEDDY, Records Clerk.
E. J. BARKE, Clerk.
L. R. PARKER, Clerk.
Miss F. M. DOOLAN, Clerk-Typiste.
Miss J. E. MURPHY, Clerk-Typiste.
Miss B. A. MURPHY, Clerk-Typiste.
Miss P. D. JOHNSON, Clerk-Typiste.
Miss H. R. PICKETT, Clerk-Typiste.
Miss R. MESSER, Clerk-Typiste.

Field Staff:

Meringa:

J. H. BUZACOTT, Senior Plant Breeder (I).
G. WILSON, Senior Entomologist (II).
J. C. SKINNER, Senior Geneticist (II).
G. BATES, Senior Adviser.
E. A. PEMBROKE, Senior Adviser.
B. E. HITCHCOCK, Asst. Entomologist.
A. G. BARRIE, Asst. Agronomist.
N. G. GRAFF, Technical Officer (I).
F. C. LINDSAY, Technical Officer (I).
L. E. RODMAN, Field Assistant.
Miss D. A. M. COLLINSON, Clerk-Typiste.
Miss M. BUZACOTT, Clerk-Typiste.
J. CHAPMAN, Laboratory Attendant.

Innisfail:

S. O. SKINNER, Senior Adviser.
I. T. FRESHWATER, Field Assistant.

Ingham:

O. W. D. MYATT, Senior Adviser.

Ayr:

G. A. CHRISTIE, Senior Adviser.
J. WESDORP, Asst. Agronomist.
L. S. CHAPMAN, Adviser.
J. ANDERSON, Field Assistant.
Miss R. V. PAINE, Clerk-Typiste.

Mackay:

C. G. STORY, Senior Adviser.
A. A. MATTHEWS, Adviser.
C. M. McALEESE, Field Assistant.
G. H. WHITAKER, Cadet.
Miss J. L. CRONIN, Clerk-Typiste.

Bundaberg:

H. G. KNUST, Senior Adviser.
B. G. ADKINS, Mill Technologist.
A. G. CLAIRE, Mill Technologist.
N. McD. SMITH, Senior Adviser.
J. D. HARLAND, Asst. Mill Technologist.
R. DEICKE, Asst. Mill Technologist.
R. B. MOLLER, Asst. Agronomist.
C. L. TOOHEY, Adviser.
Miss E. J. SEEDS, Clerk-Typiste.

Nambour:

C. A. REHBEIN, Adviser.

Fifty-Sixth Annual Report of the Bureau of Sugar Experiment Stations

To the Honourable the Secretary for Agriculture and Stock

Dear Sir,

I have the honour to submit the Annual Report of the Bureau of Sugar Experiment Stations for the year ended June 30th, 1956.

My introductory remarks cover some brief comments on the 1955 sugar season, the prospects for the 1956 crushing, and the work of the Bureau staff during the year under review. More detailed reports of the work of the various divisions are given under the headings of soils and agriculture, plant breeding, entomology, pathology and mill technology. In addition, the operations of our four Experiment Stations are reviewed and the usual space is allocated to industry statistics.

THE 1955 SEASON

Queensland's production of cane for the period under review—the 1955 crushing season—totalled 8,616,163 tons. It was by no means a record year, being 1,248,142 tons below the 1954 production. To some extent the smaller crop was planned, as a result of the proclaimed intention to accept cane only up to peak requirements; growers in many instances reduced fertilizer applications. Seasonal variability also played some part in reducing the rate of crop development.

The area harvested fell to 365,252 acres, a decrease of 2,400 acres, which is a normal fluctuation on stabilised aggregate assignments. The industry is settling down after the rapid expansion period and only relatively small acreages are still being developed as new cane land.

The sugar output for the State was 1,135,675 tons in terms of 94 net titre. This was some 35,000 tons below the peak and was the worst recovery of sugar per ton of cane for many years. The quality of the cane crop was affected by the heavy and extended wet season, by the undue degree of cloudiness in the tropical divisions, and by the proportion of lodged cane in several areas.

New South Wales cane production and 94 n.t. sugar output during 1955 amounted to 284,539 and 36,028 tons respectively. The total Australian figures were, therefore, 8,900,702 and 1,171,703 tons.

The industry, collectively, has frequently expressed concern in post-war years at the lowering sugar content of the State's crops as a whole. In recent years it has become commonplace to have a requirement of 7.3 to 7.6 tons of cane to make one ton of sugar, whereas before the war the figure was normally below seven. It is most unlikely that this quality ratio will ever again revert to the pre-war figure. The deterioration in cane quality is very closely related to an overall change in the varietal picture in practically every producing district. Hybrid canes, with increased vigour and resistance to harsh conditions, have replaced the old, noble types, and have brought with them the ability to continue growth throughout the cooler and drier months. The maturity period is less marked than in the noble canes, and the general result is a somewhat lower sugar content. Another factor which is affecting post-war cane quality is the marked deterioration in the condition of cane as delivered to the mills; the accompanying extraneous material is contributing appreciably to the reduced sugar recovery.

The harvesting season began, perforce, before the very heavy and extended wet season had finished, resulting in an unsatisfactory start, harvesting difficulties on saturated lands, and problems associated with large areas of tangled

and lodged cane. Sugar content of crops was disastrously low in some of the wetter districts. And an overtime ban by certain unions had a marked effect on milling operations. Seen in retrospect, it was not a satisfactory season in factory or field.

The first of the mills to commence operations was Babinda on May 31st, 1955, and the season did not finish until January 26th, 1956, at Invicta. Although it was not a year of record

Fig. 1—Cyclone damaged Badila in the Babinda district. Leaves are shredded and the crop lodged, but there is no breakage.

crushings, eight factories extended their operations into the new year.

Recent annual reports have recorded, as an indication of aggregate crushing capacity of the State's mills, the average State crushing over a seven-week period at the peak of the season.

Fig. 2—A close-up of Pindar breakage. Note development of shoots from top buds.

Fig. 3—An example of the hundreds of acres of decapitated Pindar in the Cucania area of Babinda.

In 1955 the weekly average for a period of this length was 372,235 tons, exceeding the previous year by some 12,000 tons.

Rapid progress has been made at the site of the Mackay bulk handling terminal and it is anticipated that this very large installation will be ready for operation in the 1957 season. Local mills have also prepared themselves for bulk handling of the raw sugar from mill to transport units, and equipment has been designed and

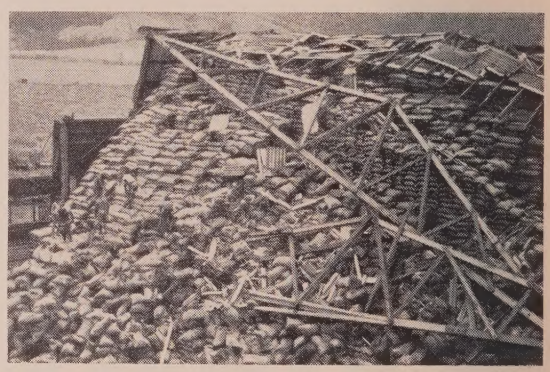


Fig. 4—The force of the wind is exemplified in this sugar-shed damage.

tested for road transport of the sugar from certain factories. At Lucinda, which is to be the second in the chain of bulk storage and loading ports, work is under way, but this port will not be functioning with bulk sugar until later than Mackay.

PROSPECTS FOR THE 1956 SEASON

One of the most remarked on features of the sugar industry in recent times has been the exceptionally good seasonal conditions which have covered an unbroken period of five years. Since 1951, which was sub-normal in productivity, all districts have experienced a rainfall pattern which has favoured crop development on a better-than-average plane. At the beginning of 1956 the overall prospect was excellent and, in the far north in particular, the less intense wet season with lower cloud incidence was conducive to better growth. The intense cyclone in early March, which swept all cane areas from Proserpine to Mossman, transformed a crop which promised near-record production to one which will be little, if any, in excess of peak proportions. As is usual, following a cyclone or a flood, the early estimates of loss were far in excess of actuality, but certain districts, notably Babinda, suffered serious losses which will become fully apparent only at the end of the crushing period.

In other areas of the near and far north, where breakage of cane was not so marked, indirect losses of considerable magnitude will be experienced as the result of higher harvesting rates on lodged and tangled cane. Accompanying such loss is the inevitable lower sugar content of the recumbent and decapitated crops.

The crop estimate, prepared in May, 1956, indicated a cane expectation of 8,722,000 tons with an anticipated sugar output of 1,163,000 tons of 94 n.t. The existing peak allocation for Queensland mills, in the aggregate, is 1,170,900 tons of 94 n.t. sugar. The deficiency of some 8,000 tons of sugar is insignificant. Seasonal conditions from May onwards could result in either a reduction or an increase on the estimated crop and there is already evidence that the predicted losses from cyclone damage are less serious than anticipated. It is, accordingly, probable that the aggregate peak could be closely achieved from the crops offering in all districts.

On the basis of individual mill estimates received the area available for harvest will be in the vicinity of 378,000 acres, which would exceed the 1955 acreage by some 13,000 acres. This is evidence of the continuing development of the new areas which were assigned during the expansion period and also, in some degree, of the normal annual fluctuation of planted acreage.

An interesting feature of the estimates received from the various mill areas was that all districts from Proserpine south have sufficient cane to exceed their peaks, whereas only three of the fourteen districts north of Proserpine assessed their crops as being in excess of peak requirements; these were Inkerman, Victoria and Macknade. Bundaberg district crops are particularly good and it is notable that Isis, with a crop estimate of 415,000 tons, is the first mill south of the Burdekin to ever achieve a crop in excess of 400,000 tons.

New South Wales production in the 1956 season is expected to reach 312,000 tons of cane and 37,500 tons of 94 n.t. sugar.

Since the beginning of the crushing season in June, 1956, mill crushing rates have been adversely affected by wet weather and inadequate cane deliveries. The last-mentioned is not the result of cane cutter shortage or disinclination on the part of growers to harvest crops early, but is a direct outcome of the cyclone. It has been impossible to load the normal weight of bent cane on to the trucks, and cane deliveries have dropped accordingly. As the season progresses, and the lodged and broken cane is harvested, truck weights—and crushing rates—will doubtless improve considerably.

Estimate and Final Figures

The final estimate of the 1955 crop was collected during October, 1955. This indicated that the harvested tonnage would approximate to 8,900,000 tons of cane with an expected outturn of 1,170,000 tons of 94 n.t. sugar. The figures achieved failed to reach the estimate, being 8,616,163 and 1,135,675 tons of cane and 94 n.t. sugar respectively.

Abnormally heavy arrowing was the principal factor which prevented the attainment of the estimate; late growth was much less than in a normal, lighter-arrowing year. The sugar output was similarly affected by excessive cloud over a prolonged period in many districts and this is shown by the poor quality ratio for the areas north of Townsville.

Crop Estimating

It is interesting to compare the mill crop estimates as given in May, 1955, with the actual crops harvested in each area. In the northern division, Mossman to Ingham, the final crop was 8.5 per cent. below estimate, in the Lower Burdekin 8.2 per cent. below, in Proserpine-Mackay 3.4 per cent. below, and in the southern division 6.3 per cent. below. These figures give a pointer to the areas which were worst affected by the heavy arrowing and pithiness—with consequent loss of weight—which were features of the 1955 crops.

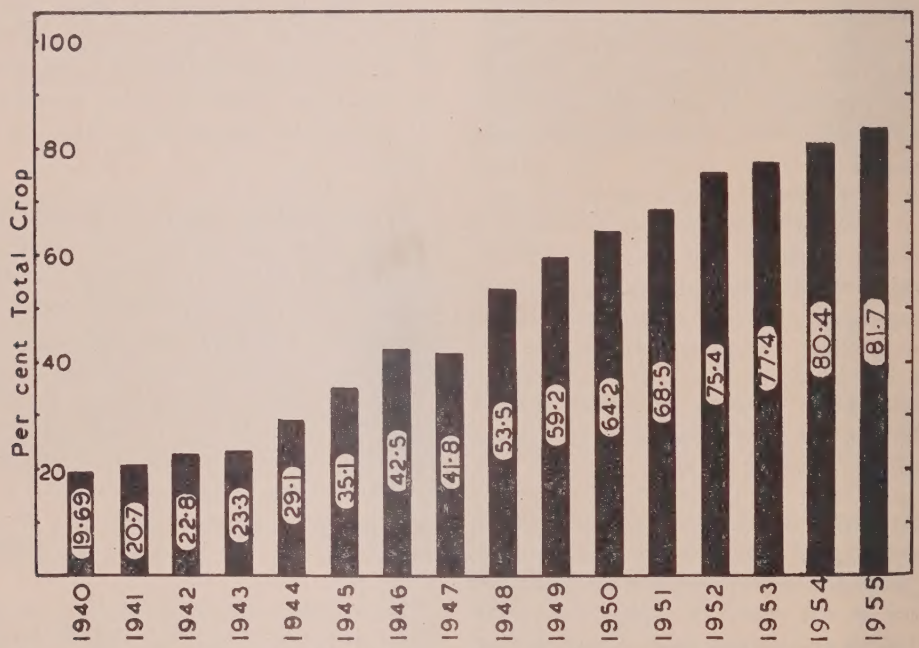


Fig. 5.—Between 1940 and 1955 the percentage of Queensland bred varieties in the total crop has increased from less than 20 to nearly 82 per cent.

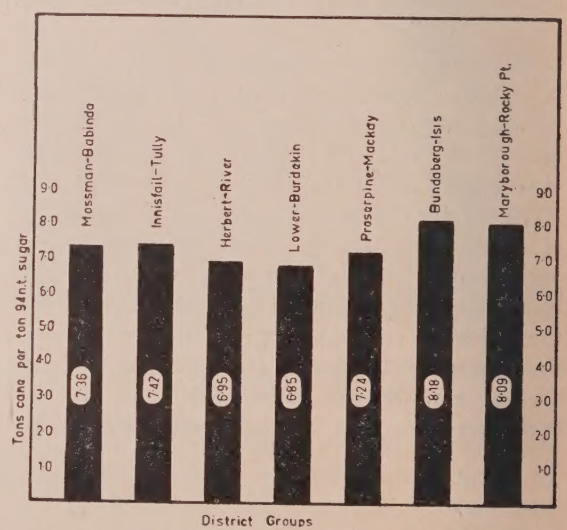


Fig. 6—Sugar ratio averages for ten years 1946-1955 indicate in which districts the sweetest cane is grown.

Q.50 still Heads the List

For the third successive year Q.50 retained pride of place as the industry's most widely grown variety. The total amount crushed was 2,600,844 tons, representing 30.2 per cent. of the State's crop. This was an advance of 2.2 per cent. on 1954. There has been appreciable extension of this variety outside the confines of the central area and it enjoyed considerable popularity in the southern divisions as well as in parts of the north. Some of the concern previously expressed at Q.50 constituting too high a proportion of the Mackay district crop has been allayed by the interest shown in several newer canes in that area.

The Contribution of Badila

Badila's steady but sure decline is by no means indicative of an early demise. Although superseded in many of its former strongholds, it is still the premier variety in South Johnstone and represents a sizable proportion of the crop in several other mill areas.

The sugar industry of the State might well consider some form of recognition of the inestimable contribution made by Badila to Queensland's sugar economy. The only acknowledgment in existence to-day is a small railway siding which, incidentally, is mis-spelt "Badilla." It would be very difficult, if not impossible, at this late date to assess with accuracy the tonnage of this variety which has been grown since its introduction from New Guinea in 1896; but varietal statistics have been collected by the Bureau since 1934, and in the period of the last twenty-two years approximately 29,000,000 tons of this outstanding cane were milled. The predominant part which Badila played in developing the North Queensland industry is surely worthy of commemoration—preferably in the Cairns area where it was first established on Australian soil.

Ratio of Ratoon to Plant Cane

There has been a pleasing improvement in this ratio in the 1955 season. Theoretically, with Queensland's rotational system there should be twice the area of ratoons harvested as of plant cane. For the season under review the ratio reached 1.79 compared with 1.49 in 1954. The figures illustrate a greater awareness of the long ratooning ability of most modern canes, as well as the desire on the part of growers to reduce farm costs by eliminating some of the expensive annual planting. In the Lower Burdekin where the "plant cane only" policy is so strongly entrenched the ratio for 1955 was 0.78—a slight improvement on the 0.71 of the previous year. An investigation into the reasons for this practice in that area has failed to elicit any convincing reason for not growing ratoons more extensively. Mackay also has a lower ratio—1.50—than would be expected from a district where strong ratooning canes are grown.

District Cane Yields

Next to the Lower Burdekin, which always produces the heaviest crops per acre, the Mossman-Ingham belt just managed to beat Bundaberg-Gin Gin. Mackay and Proserpine were in last place in productivity. Inkerman again topped the State's mill areas with 38.2 tons of cane per acre, but this was well below the 46.4 tons recorded in the previous year. State-wise the yield fell from 26.83 tons of cane per acre in 1954 to 23.59 in 1955.

Crushing Periods and Crushing Rates

For the 1955 season the 31 mills had an average crushing season of 24.91 weeks, being 3.25 weeks shorter than in 1954. This shortening of the crushing by some eleven and a half per cent. coincided with a drop of nearly thirteen per cent. in cane crushed.

Nevertheless the average crushing rate for the 26 mills which operate within the Mutual Control scheme rose from 93.51 in 1954 to 97.20 tons per hour in 1955. Sixteen of these mills exceeded an average crushing rate of 100 tons per hour for the season.

Staff Losses, Appointments and Transfers

The only staff losses which occurred during the year were the resignation of an Asst. Pathologist, a Clerk and a Clerk-typiste. All were replaced.

Two members of the Mill Technology Division who completed the Post Graduate Course in Mill Technology were transferred to Bundaberg, and the Field Assistants at Innisfail and Ayr were exchanged so that their experience would be broadened.

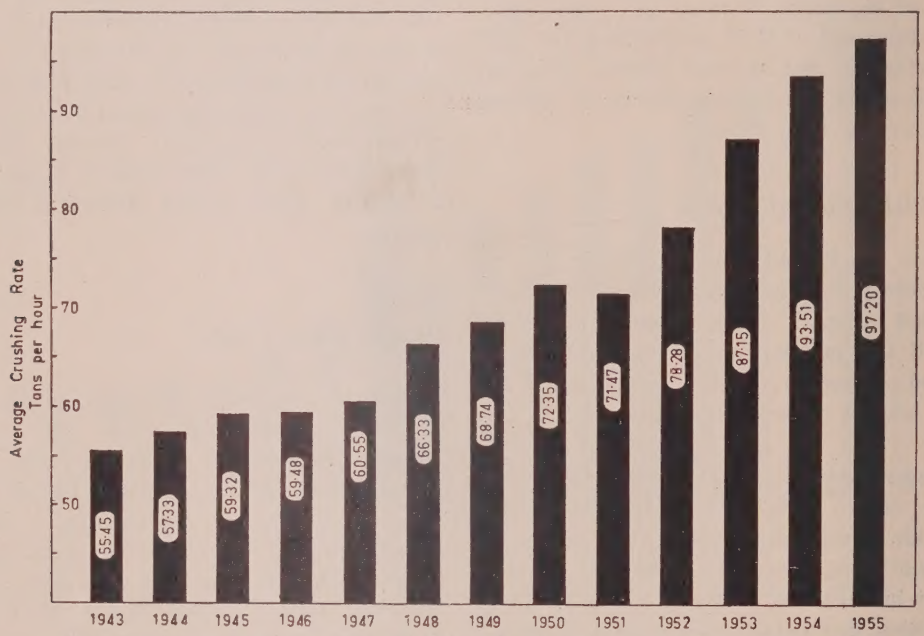


Fig. 7—Average crushing rate of Queensland mills (excluding C.S.R. mills and Rocky Point); Pioneer and Inkerman are excluded in 1943 and 1944; Mt. Bauple ceased operations after 1950.

New Services for Cane-growers

Early in the 1956-57 year one of the Bureau's plant pathologists will be transferred permanently to Meringa Experiment Station. This move is the result of an increasing awareness of the necessity for on-the-spot investigations of such diseases as are present in North Queensland. In addition to conducting investigations on the more important diseases the pathologist will be available for advice to farmers on disease problems, for discussions with supervisors of Cane Pest and Disease Control Boards, and eventually, it is hoped, for the preparation and supply to local growers of green manure cultures. The North Queensland growers are a long way from the Bureau's Brisbane laboratories and this service is being provided so that their requirements may be supplied more expeditiously.

Later in the year the Bureau's senior Soils Chemist will be transferred to Mackay where provision has been made for a modern soils laboratory in the new building at the Experiment Station. Mackay district canegrowers' soils will then be analysed in the Mackay laboratory and this will obviate the delays now occasioned in sending such soils to Brisbane and awaiting the subsequent fertilizer advices. It is planned, at a later date, to expand this work into a general advisory service on agronomy problems.

Bureau Director Visits Philippines

The Victorias Milling Co. Inc. of Occidental Negros, Philippine Islands, invited the Director

to spend a month in the district to advise on means of improving production. Victorias draws its cane supply from a district covering some 92,000 acres, and the factory crushes annually some 1,200,000 tons of cane. The Director, by arrangement with the Sugar Experiment Stations Board, utilised some long service leave for the purposes of the visit which was made in October, 1955.

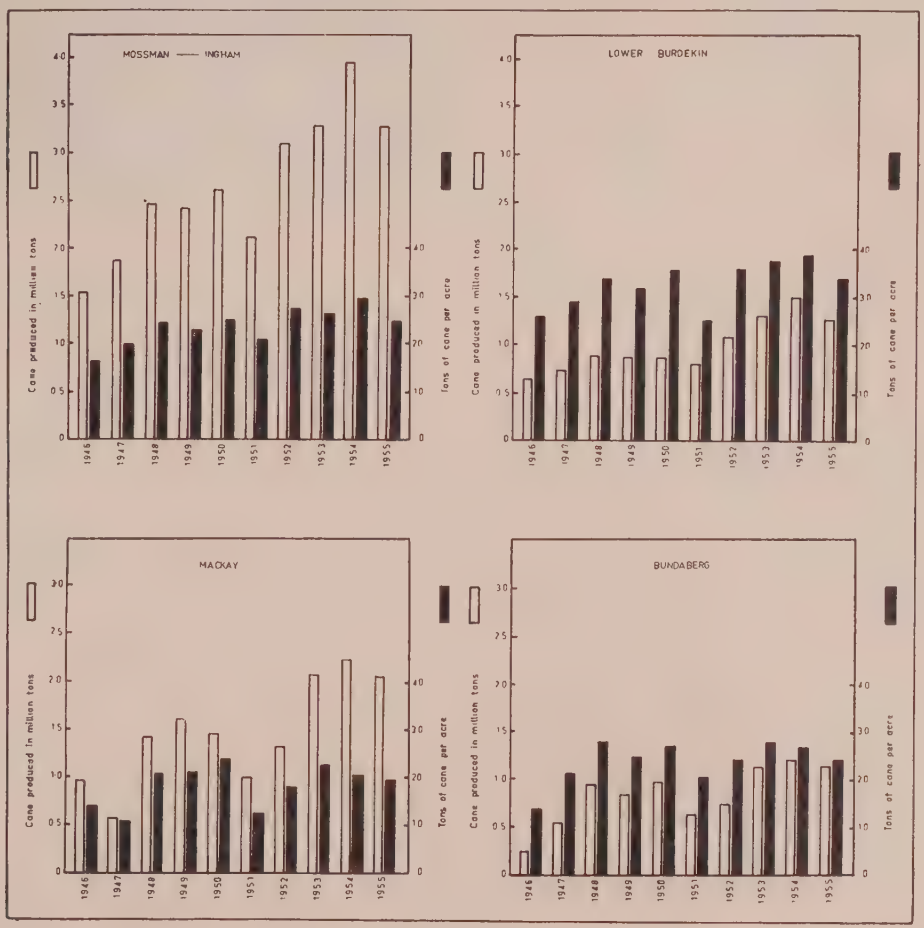


Fig. 8—Total cane production and tons per acre in the four major districts during the past ten years.

The Mill Technology Division

In addition to the investigational work which is previously planned by the Mill Research Committee—representing 26 mills in the State—the Division fills a role in factory trouble-shooting. The value of this service was exemplified during the year in a detailed investigation of factory operations at Mossman where high undetermined losses, with related low coefficient of work, were causing considerable concern. The recommendations made following the investigation have been implemented by the mill administration and the beneficial results are already apparent early in the 1956 crushing.

The strengthening of the staff in this Division, brought about by the addition of two graduates who have also completed the Post Graduate Course in Mill Technology, will allow an increase in research activities as well as an improvement in advisory work to the mills. As a first step in this improvement some further decentralisation of the Division is envisaged, and it is hoped to have, by the 1957 season, a resident mill technologist in North Queensland who will be on call to local mills requiring his services.

The Innisfail Sub-Station

The first year's work on seedling planting on this wet-belt sub-station was successfully carried out. Approximately 1,500 seedling canes were grown on an average-quality, uniform piece of land and these will be selected during 1956 with an eye to such types as perform well under the prevailing high-rainfall, low-sunlight conditions. Selected canes will be replanted and reselected progressively and judged on their performance relative to the existing commercial varieties of the district. Among the many desirable features of a cane for that region—features which will be taken into consideration during selection—are non-arrowing, high sugar content, resistance to lodging and resistance to leaf scald and chlorotic streak diseases.

Aeroplane Fertilizing

Although this is an established method in some overseas countries, the first attempt to apply sulphate of ammonia by aeroplane to a cane crop was made in Queensland during the year. This experiment was conducted at the Bureau's Pathology Farm near Brisbane. Application was at the rate of two hundredweight per acre and the trial run was quite successful in regard to accurate placement. No conclusions can be drawn from this initial work since comparisons between aerial and ground-machine application would be desirable on a larger scale. However the operation had its value inasmuch as it will now be extended to larger commercial areas for economic assessment.

Giant Sensitive Plant

The alarm at the increase of this noxious weed pest increased during the year with the discovery of a large number of infestations in northern cane areas. The main incidence is in the South Johnstone, Mourilyan and Tully areas, but it has been recorded on farms in Goondi and Hambledon districts and on one property at Mossman. Although declared a noxious weed under the Local Government Acts as early as 1948 — at the instigation of the Bureau — it was not until the last year or so that any attempt was made to control or eradicate the pest on non-private lands. The prolific seeding of the plant and the proved longevity of the seeds in the soil complicate the eradication measures. Cane Pest and Disease Control Boards, operating within the Sugar Experiment Stations Acts, are not empowered to exercise control of noxious weeds and consequently the responsibility for eradication rests with the land owner.

Fig. 9—The first aerial application of sulphate of ammonia to sugar cane in Queensland. The photograph was taken at the Pathology Farm, Eight Mile Plains, near Brisbane.

Copper Deficiency in Sandy Soils

Several more cases have come to light during the year of crops growing on small areas of sandy soils exhibiting symptoms of copper deficiency. The symptoms have now been reported from Mossman, Mourilyan, Mackay, Coonarr Creek and Splitter's Creek at Bundaberg, and at Nambour. Spectacular results have been obtained from applications of copper sulphate but the relatively high price of this material has prompted enquiries into the availability of some copper-bearing ores which may prove suitable for correction of the deficiency.

Nodulation of Legumes

The principal reason why green manure (legume) crops are recommended on fallows in the sugar industry is their ability to act as nitrogen gatherers for the use of the subsequent cane crop. Other valuable functions they perform include grass control and erosion control in the wet season, and the provision of

organic matter to the soil. But there is reason to believe that in some cases they are not acting efficiently as fixers of atmospheric nitrogen even when the seed is treated with the necessary culture. The reason for this is not clear, but cases are known where nodulation has not occurred. This matter will be investigated, since the production of a non-nodulated legume crop adds nothing to the soil nitrogen.

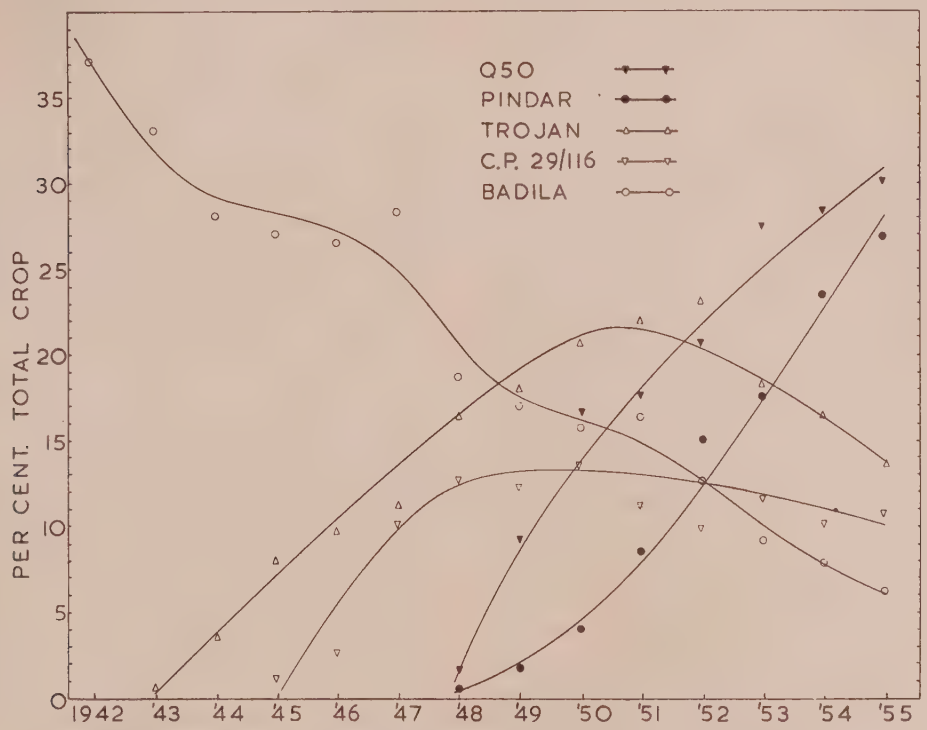


Fig. 10—Illustrating the decline of Badila, the rise and fall of Trojan, the probable falling off of C.P. 29/116, and the continuing rise of Q.50 and Pindar in recent years. Points on the curves represent percentages of the total crop.

Malabar Pea—A New Green Manure Crop

During 1955/56 many new legumes have been tested for the first time, or re-tested to confirm previous findings. One of these, a cowpea which originated in India, has shown a very high degree of resistance to bean-fly attack and to wet-season wilt. It has been named Malabar Pea, and the small quantities of seed available have been handed over to commercial seed growers to propagate for the sugar industry. Although velvet beans are very popular in the industry—in all districts from north to south—there is still a persistent demand for a short-fallow cover crop of the cowpea type, and Malabar Pea is the most suitable one tested to date.

Cyclone Damage at Meringa

The disastrous cyclone of March, 1956, caused serious damage to buildings on the Northern Experiment Station. The seedling glasshouse was almost completely demolished and other extensive damage occurred. One end of the glasshouse was repaired to give sufficient space for this year's seedling raising, but the investigational work associated with controlled temperature crossing will have to be discontinued pending the erection of a new glasshouse. It is hoped that this will be erected, and in operation, in time for the 1957 crossing season. An order has been placed for a prefabricated, rustless, metal-frame unit with floor dimensions of 28 by 45 feet.

The Rise of Q.57

This cane variety, bred at Meringa Experiment Station, first appeared on the approved

lists for the Lower Burdekin mill areas in 1954, and for the mill areas Mossman to Babinda in 1955. From those recent beginnings it is estimated that 159,000 tons will be harvested in the Lower Burdekin this year, and at least 20,000 tons in the far northern districts. The high degree of lodging and stalk-breakage resistance exhibited by Q.57 in the March cyclone this year has attracted wide interest on the part of growers and it is certain that plantings in 1956 will be higher than would normally be expected.

Breeding for Lodging Resistance

There is ample evidence now that lodging of cane is a genetical factor, and the cane breeders have added one more requirement, anti-lodging, to their long list of desirable characters in a commercial variety. Quite recently the search began for varieties which would resist lodging on very rich land, and already such canes as Q.57, I.233 and L.469 have demonstrated their ability to remain erect under conditions where all commercial canes regularly lie down. The seedling I.233, in particular, has performed surprisingly well under cyclone and flood conditions. During the cyclone in March, Q.57 and Q.59, which were both growing in extensive and well-scattered areas, stood up to winds strong enough to strip all leaf-blades from the mid-ribs. Lodging resistance is important in Queensland, where recumbent cane not only loses sugar content but attracts higher harvesting charges.

Changes in Approved Varieties

During the year Pompey was removed from the Mossman approved variety list, and thus disappeared from the commercial cane-growing field after a long period of years. Q.59 appeared for the first time on the lists and shows promise of attaining some popularity in the areas north of Townsville. Both Q.59 and Q.57 have received much more attention from growers since the March cyclone, when both varieties demonstrated a high degree of wind resistance.

In the central and southern areas the new varietal position has never been better. Several "Q" canes are ready for approval, and more are competing for a place either as special purpose canes or as replacements for the existing commercial varieties of those districts.

The Varietal Picture

Although over 80 per cent. of the State's crop was made up of Q.50, Pindar, Trojan, and C.P.29/116—the same four varieties which topped the poll in 1954—there is constant movement among the minor canes. Some older ones are disappearing from the varietal census, others are appearing for the first time, and the relative importance of many is altering. Several new "Q" canes are being grown commercially for the first time; Q.64 is appearing in the north, where it will be of value on intermediate lands not good enough for Badila; Q.56 and Q.63 will find a place in the central area; while Q.61 has been distributed in the southern district. Co.475 shows distinct promise for the poorer lands of the far north, but some doubt exists regarding its tolerance to red rot.

Cane Varieties and Disease Resistance

A great deal has been achieved in Queensland in eradicating important cane diseases by using resistant varieties. This method has been the principal tool in ridding the industry of gumming, downy mildew, and Fiji diseases. But much remains to be done, and the problems of red rot and leaf scald are by no means simple ones. A good proportion of the new seedling canes which show commercial promise for North Queensland conditions are sufficiently susceptible to leaf scald to ensure that the disease will be perpetuated. The time is opportune for a planned attack on this disease with a view to complete eradication. The campaign would involve a cane breeding and disease resistance trial programme specifically aimed at leaf scald and, simultaneously, a restriction on the use of cane plants from all infected fields.

A somewhat similar attack, although differing in detail, is necessary for red rot disease. The latter is normally a disease of over maturity, although some varieties can be affected early in the season. From the aspect of monetary losses red rot can be of great importance, and a more effective control is justified.

Ratoon Stunting Disease

The results of a large number of trials give further confirmation of the serious losses which have been, and still are being, caused by this disease. Any industry facing the problem of a narrowing margin between costs and gross returns must be vitally concerned with crop losses of the order of 15 and 20 per cent. Even if the average loss in a mill area were only one per cent., the sum of money involved is of the order of £16,000.

There has been some change in the details of recommended treatment for disease control in planting material. The longer period involved is designed to counteract any deficiencies in treatment tanks, and to ensure that pithy setts or high-fibred canes, which may conduct heat less rapidly—and escape a complete cure—are adequately treated.

Downy Mildew Again !

The finding of downy mildew disease on a farm in the Bundaberg area during 1956 was an occurrence which may remain shrouded in mystery. The last known stool of this disease in the Queensland sugar industry was eradicated in 1950 and, even during the period when the disease was prevalent, it never occurred on this particular farm nor on neighbouring properties. Fortunately, the disease is restricted to the one small property and the measures already taken, and to be taken, should ensure that the property is cleaned up. Occasional outbreaks of this nature, although not welcomed, demonstrate the value of permanent supervisors and inspectors on Cane Pest and Disease Control Boards. On this occasion the predominance of the virtually immune C.P.29/116 in the district must also have played a major part in minimising spread of the disease.

Chlorotic Streak is Spreading

For many years the poorly drained soils of the sugar belt have, with few exceptions, been characterised as chlorotic streak country. The disease is universal north of Townsville, it has been known for years in the Moreton and Maryborough areas, and was recorded in Mackay a couple of years ago. During the past twelve months it has been detected on some badly-drained land in the Isis and a single diseased stool was recorded at Fairymead. Since the research work on ratoon stunting disease is tapering off to some degree, Bureau pathologists are making chlorotic streak a top priority investigation. There is much to be learned regarding the nature and spread of this disease.

Problems in Cross Pollination

The year's investigational work has made clear that the material used in our crossing lanterns was not sufficiently close-woven to prevent the entrance of some foreign pollen. It also confirmed that there was a low level of pollen contamination in the open-forest crossing paddock. These findings are disconcerting to the extent that they cast some doubt on the male parentage of certain hybrid canes. In some cases varieties previously recorded as selfs may be crosses. As a result, all individual crosses will, in future, be made in new lanterns covered with more closely woven material, and other precautions have been taken to exclude, as far as practicable, any adulteration from outside.

Nematode Damage to Crops

Although a very minor pest of the sugar cane crop, there have been two recorded occurrences of severe crop reduction in the Mullett Creek area north of Bundaberg, and of minor damage in two other Bundaberg locations. The varieties C.P.29/116 and Pindar were affected but Co.290, used as supplies in the C.P.29/116 field, showed a good degree of varietal resistance. Plantings of a range of varieties were made in the area in an attempt to establish the extent to which varieties may offer a control of the infestation.

Grub Control—An Appreciation

The Bureau was honoured, during the year, to receive from the canegrowers of the State a bronze plaque commemorating the research which led to the control of the cane grub. The plaque was presented by the Queensland Cane Growers' Council, on behalf of the growers,

and it will be erected on a granite block in the grounds of Meringa Experiment Station where the initial research work was conducted. The inscription on the plaque is shown in Figure 11.

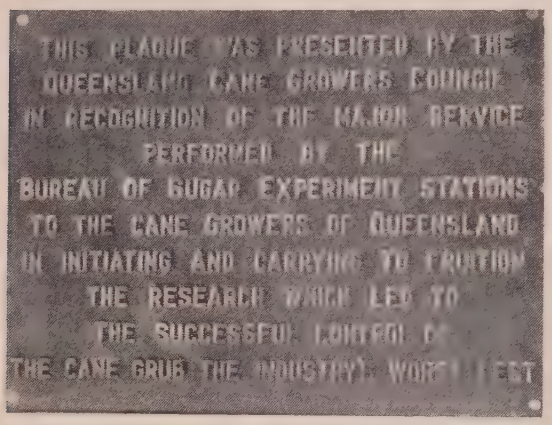

THIS PLAQUE WAS PRESENTED BY THE
QUEENSLAND CANE GROWERS COUNCIL
IN RECOGNITION OF THE MAJOR SERVICE
PERFORMED BY THE
BUREAU OF SUGAR EXPERIMENT STATIONS
TO THE CANE GROWERS OF QUEENSLAND
IN INITIATING AND CARRYING TO FRUITION
THE RESEARCH WHICH LED TO
THE SUCCESSFUL CONTROL OF
THE CANE GRUB THE INDUSTRY'S WORST PEST

Fig. 11—The canegrowers of Queensland have demonstrated their appreciation of the successful research into cane grub control by presenting this bronze tablet to the Bureau. It will be erected at the Meringa Station.

BHC and the Cane Grub

The year 1956 marks the tenth anniversary of the first experiment which demonstrated that BHC would protect cane crops against greyback grub attack. Figure is a photograph of the first crop which was grown in Queensland with BHC as a protective insecticide. The three middle rows were treated with the very small quantity of BHC available, and the rows on the right and left were untreated. From this small beginning in 1946 the present practice of BHC application developed, reaching a peak in 1953 when 60,372 acres were treated at planting time.

Many people in the industry have speculated from time to time as to what this discovery meant to the canegrowers of the State in terms of added income. Statistics of cane losses as the result of grub damage are available over a period of years, but they do not take cognisance of the losses caused by the light, but widespread, grub infestations which took toll of the crops without causing well-defined grub damage symptoms. Consequently any statistical assessments of loss are very conservative.

Records show that during the six years 1946 to 1951 the average calculated cane loss was 63,500 tons. On present-day cane values this represents some £250,000, so we are not overestimating the position if we state that the canegrowers of the grub-infected areas are benefitting to that extent in each of the present-time years.

Minor Pests of the Crop

Control of our major cane pests with BHC is an accomplished fact, and the application of the insecticide to the land in the previously affected areas is a routine farm practice. The only investigational work now proceeding with the greyback and frenchi grubs, and the wireworm, is the screening of newer insecticides for assessment of efficacy and cost. However, satisfactory control of some of the minor grub pests—*furfuracea* and *trichosterna* — has not been achieved with BHC, and the sporadic nature of the damage has rendered more difficult the control experiments with other insecticides; the position regarding *consobrina* is not clear cut, but with *Rhyparida* spp. there is reason to expect success. Work is also in progress in an attempt to discover a control agent for *margarodes*, occurrences of which have been reported from several districts. Some success has been achieved in protecting crops against damage caused by the funnel ant; details are given in the entomological section.

Bagasse, Molasses and Wax

The sugar industry, as a whole, continues to take little interest in by-product usage. This disinterest is in contrast to the developments witnessed by Queensland sugar technologists who visited India early this year. The Bureau's investigational work on cane wax has continued during the past season and the prospects of success with the wet extraction process are much brighter. The Bureau has also designed plant on a pilot scale for drying bagasse, screening to desired size and mixing with molasses to prepare a bago-molasses stockfood. This plant will be built and operated by a sugar mill. Its initial function will be the preparation of sufficient feed for an animal feeding test.

PUBLICATIONS BY BUREAU STAFF

In the Proceedings of the International Society of Sugar Cane Technologists.

Buzacott, J. H.: Breeding Canes for High Sugar.

Hughes, C. G., & Steindl, D. R. L.: Some Further Developments in the Study of Ratoon Stunting Disease in Queensland.

King, N. J.: The Queensland Sugar Industry.

Nicklin, J. H.: Cane Carrier Control.

Skinner, J. C.: The Inheritance of Hairiness in Sugar Cane.

In the Proceedings of the Queensland Society of Sugar Cane Technologists.

Adkins, B. G., Notes on Blanchard Crystallizers.

Bates, G.: Hot Water Treatment of Cane Plants at the Northern Sugar Experiment Station.

Buzacott, J. H.: Breeding Cane for Milling Qualities.

Buzacott, J. H.: The Low Sugar Content of Cane in 1955.

Claire, A. G.: The Use of Molasses and Bagasse in Stockfeeds.

Story, C. G.: Mechanical Loading in the Mackay District, 1955.

Toohey, C. L.: The Present Status of Pre-emergence Spraying in the Bundaberg-Childers Area.

Vallance, L. G.: Nitrogen Response in Plant Cane.

In the Louisiana Sugar Journal

King, N. J.: The International Sugar Technologists Congress in India.

In the International Sugar Journal

King, N. J.: Sugar Cane Disease and Soil Organic Matter.

In the Proceedings of the Ninth International Congress of Genetics.

Skinner, J. C. (with Harland, J. C.): Genetic Aspects of Excised Roots in *Senecio vulgaris L.*

Report

Buzacott, J. H.: A Report on a Visit to the Philippine Is., India, Mauritius and South Africa.

In the Australian Plant Breeding and Genetics Newsletter

Buzacott, J. H.: Parthenogenesis in Sugar Cane.

Buzacott, J. H.: Counting Sugar Cane Chromosomes from Leaf Squashes.

Skinner, J. C.: Cyclone Damage to Sugar Cane.

Operations Reports

56/1. Extraction of Crude Wax from Wet Filter Mud—Progress Report.

56/2. The Lytron Tests at Millaquin, 1955 Season.

56/3. The Soda Ash Tests at Qunaba, 1955 Season.

Technical Communications

1955 No. 1, Leverington, K. C.: The Nature of the Clay Fractions of Some Queensland Soils.

1955 No. 2, Hughes, C. G., & Steindl, D. R. L.: Ratoon Stunting Disease of Sugar Cane.

1956 No. 1, Skinner, J. C.: The Effect of Maleic Hydrazide on the Sucrose Content of Sugar Cane.

Annual Synopsis of Chemical Control Figures

Twenty-fourth Edition.

Periodic Publications

Four numbers of the Cane Growers' Quarterly Bulletin and one Newsletter were issued.

INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS

Fig. 12—At the inaugural welcome to delegates in Bombay the General Vice-Chairman, Mr. Norman J. King, responds to the welcome tendered by the Deputy Minister for Food and Agriculture.

The Ninth Congress of this Society, which was formed at a Pan Pacific Food Conference in 1924, was held in India from January 6th to February 2nd, 1956. Twenty-five sugar producing countries were represented at the meeting and the non-Indian delegates totalled approximately 100. Queensland, with a delegation of 17, had the largest regional representation.

The Bureau was represented at the Congress by the Director, Mr. Norman J. King, who was General Vice-Chairman of the Congress, and Mr. J. H. Nicklin, Chief Technologist (Engineer). The two industry members of the Sugar Experiment Stations Board, Messrs. L. G. Scotney and J. W. Inverarity, attended on behalf of the Board. Subsequent to the Congress all four delegates visited parts of the Philippines to study cane growing and milling methods in that country.

Bureau staff officers contributed five papers to the Congress proceedings.

THE SUGAR EXPERIMENT STATIONS BOARD

Meetings were held during August and December, 1955, and March and June, 1956.

The Deputy Chairman and the industry members visited Experiment Stations during the year and took the opportunity to inspect station activities and operations, and to discuss industry research and extension matters with the local officers. The Board was also represented at Station Field Days held during the period.

Considerable discussion took place during the year on the subject of a new headquarters for the Bureau in Brisbane. Subsequent to receipt of advice from the Government that Crown land could not be made available for a building to house the Bureau and other statutory sugar organisations, it was decided to purchase a suitable site for erection of a "Bureau" building. At the end of the year under review an option was obtained on land in a good locality and City Council approval has been sought for building.

Simultaneous with these negotiations a contract was let for a new building on the Mackay Station with space and facilities for

administrative, extension and research staff. This building is now well advanced and will be ready for occupancy before the end of 1956. The age of the existing building at that centre, the numerical increase in the staff, and the policy of stationing research staff at country centres made this project essential.

Staff changes within the Bureau were at a remarkably low level. Only three junior staff members were lost by resignation and all were replaced.

The Board, in considering its financial commitments for the 1956-57 year, was faced, on one hand, with increasing operational costs and, on the other, with an income restricted to a levy on peak cane tonnage or less. Despite the justification for a slight increase in the levy, it was decided, in view of the damage caused by the serious cyclone in March, 1956, to retain the existing levy and to draw on financial reserves to maintain operations at an efficient level.

The Board considered and adopted a ten-year plan for the Bureau which had been prepared by the Director. The plan covered both staff and building requirements at all centres and aimed at improving the service to all sections of the industry. One serious obstacle to the expansion of research activities in the cane breeding field is the shortage of suitable land at Meringa. Efforts to secure an area of uniform land in the near vicinity have, to date, been fruitless.

Yours faithfully,

Director.

APPENDIX I.

"The Sugar Experiment Stations Acts, 1900 to 1954."

Statement of Receipts and Disbursements of Funds of the Sugar Experiment Stations Board for period 1st July, 1955, to 30th June, 1956.

Receipts.

	£	s.	d.
Balance, 1/7/55	12,037	1	10
Assessment	107,719	4	3
Government Subsidy	7,000	0	0
Ayr	3,934	19	10
Bundaberg	2,379	10	6
Mackay	3,317	10	3
Meringa	2,809	3	7
Sundries	9,514	14	9
Bank Overdraft	4,839	9	9
	£153,551	14	9

Disbursements.

	£	s.	d.
Salaries	76,019	9	7
General	36,079	19	2
Ayr	7,294	13	7
Bundaberg	7,420	3	6
Mackay	15,093	13	7
Meringa	11,643	15	4
	£153,551	14	9

Appendix II

C.C.S. Formula

$$\text{C.c.s. in cane} = \text{Pol in cane} - \frac{\text{Soluble impurities in cane}}{2}$$

In practice, per cent. C.c.s. is calculated by the empirical formula —

$$\text{C.c.s.} = \frac{3P}{2}\left(1 - \frac{5 + F}{100}\right) - \frac{B}{2}\left(1 - \frac{3 + F}{100}\right)$$

where —

P = pol per cent. first expressed juice.
B = brix per cent. first expressed juice.
F = fibre per cent. cane.

Sugar Values, 1955 Season.

The final prices for the 1955 Season's sugar have been declared as follows:—

	No. 1 Pool			No. 2 Pool	Total
	Home Consumption	Surplus	Total	Excess	
Tons	510,810	585,039	1,095,849	39,482	1,135,331
Per cent.	46·6132	53·3868	100	—	—
Price	£46 18 0	£39 1 0	£42 14 2	£31 10 6	£42 6 5

In addition the value for New South Wales production was:—

	Home Consumption	Surplus	Total
Tons	34,338	1,675	36,013
Per cent.	95·3489	4·6511	100
Price	£46 18 0	£39 1 0	£46 10 8

Table I

Sugar Cane Harvested, 1955 — Estimated, 1956

Domestic Tonnages	Actual Tonnages		Mills	Estimated, 1956 (May estimate)
	Accepted	Condemned		
206,657	206,657	145	Mossman	200,000
259,436	259,436	34	Hambledon	241,000
290,232	290,232	452	Mulgrave	312,000
304,794	304,794	—	Babinda	221,000
252,012	252,012	426	Goondi	237,000
248,692	248,692	—	Mourilyan	228,000
344,791	344,791	—	South Johnstone	341,852
372,435	372,435	232	Tully	335,000
620,477	625,780	439	Victoria	625,000
359,593	365,525	—	Macknade	367,000
3,259,119	3,270,354	1,728		3,107,852
226,420	215,185	1,130	Invicta	200,000
314,858	314,858	3	Pioneer	339,000
330,456	330,456	73	Kalamia	300,000
395,486	395,486	74	Inkerman	407,600
1,267,220	1,255,985	1,280		1,246,600
333,530	333,625	48	Proserpine	335,000
344,960	344,853	6	Farleigh	320,000
373,119	373,054	480	Racecourse	370,000
334,653	334,848	155	Pleystowe	350,000
322,867	322,563	359	Marian	340,000
160,145	160,331	57	Cattle Creek	160,000
201,119	201,119	51	North Eton	200,000
315,618	315,618	63	Plane Creek	340,000
2,386,011	2,386,011	1,219		2,415,000
268,759	271,627	14	Fairymead	319,325
147,328	145,940	—	Qunaba	160,000
282,041	283,429	8	Millaquin	310,000
318,078	315,210	10	Bingera	330,000
104,364	104,364	29	Gin Gin	128,000
320,292	320,292	—	Isis	352,000
102,034	102,034	32	Maryborough	158,000
135,169	135,169	—	Moreton	160,000
25,748	25,748	—	Rocky Point	35,000
1,703,813	1,703,813	93		1,952,325
8,616,163	8,616,163	4,320		8,721,777

Table II

Sugar Production (94 Net Titre), 1950-1955

Districts	1950	1951	1952	1953	1954	1955
North of Townsville	344,944	304,786	421,921	467,716	502,276	413,853
South of Townsville	534,900	399,556	512,693	752,667	789,969	721,822
Totals*	879,844	704,342	934,614	1,220,383	1,301,245	1,135,675

*Local Sales included.

Table III
Classes of Cane Harvested, 1955

Districts	Plant Cane		Ratoons		Standover		Total Acres
	Acres	%	Acres	%	Acres	%	
Northern	38,530	29·3	92,746	70·6	189	0·1	131,465
Burdekin	20,819	55·6	16,189	43·3	418	1·1	37,426
Mackay	48,841	40·0	73,094	59·9	181	0·1	122,116
Southern	19,961	26·9	47,468	63·9	6,816	9·2	74,245
Whole State	128,151	35·1	229,497	62·8	7,604	2·1	365,252

Table IV
Total and Average Yields by Districts, 1955

Districts	Tons of Cane	Tons Cane per Acre	Tons 94 N.T. Sugar per Acre
Mossman-Ingham	3,259,119	24·79	3·14
Lower Burdekin	1,267,220	33·86	4·84
Proserpine	333,530	18·77	2·49
Mackay	2,052,481	19·67	2·73
Bundaberg-Gin Gin	1,120,570	24·01	2·97
Childers-Maryborough	422,326	21·31	2·68
Nambour-Beenleigh	160,917	20·73	2·71
Whole State	8,616,163	23·59	3·11

Table V
Acres Cultivated and Harvested, Yields of Cane and Sugar, Acre Yields and Quality of Cane, 1946-1955

Year	Acres* Cultivated	Acres Harvested for Milling	Total Yields		Yields per Acre		Tons Cane per ton Sugar
			Cane	Sugar	Cane	Sugar	
1946	317,766	228,395	3,714,475	512,086	16·26	2·24	7·25
1947	332,516	220,649	4,150,987	†571,658	18·81	2·59	7·26
1948	384,213	258,585	6,433,556	†910,049	24·88	3·52	7·07
1949	395,660	275,313	6,518,021	†897,267	23·67	3·26	7·26
1950	381,545	257,562	6,691,706	†879,844	25·98	3·42	7·61
1951	388,348	273,371	5,005,172	†704,342	18·31	2·58	7·11
1952	419,834	274,757	6,841,536	†934,614	24·90	3·40	7·32
1953	466,484	332,703	8,751,063	†1,220,383	26·30	3·67	7·17
1954	486,741	367,640	9,864,305	†1,301,245	26·83	3·54	7·58
1955	—	365,252	8,616,163	†1,135,675	23·59	3·11	7·59
Averages	—	285,424	6,658,699	906,716	23·33	3·18	7·34

* Supplied by Government Statistician. † Includes Local Sales.

Table VI
† Details of Molasses Disposals for Periods 1946-1955

Usage	Tons of Molasses									
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Distillers	69,842	54,014	119,615	115,376	99,940	79,063	99,410	154,152	153,212	151,349
Fertilizer	18,938	23,276	34,655	49,293	36,446	34,529	47,260	75,781	69,446	70,691
Stock Feed	45,288	34,808	38,349	36,479	36,621	37,151	37,099	36,263	38,046	35,127
Mill Fuel	6,238	9,340	11,003	9,771	15,556	6,327	5,882	1,211	7,140	10,095
*Ferment	—	—	2,479	3,561	3,582	2,033	2,532	3,196	2,779	2,727
Other Purposes	1,575	2,047	161	1,204	231	9	151	217	352	1,179
Wasted	415	99	1,099	1,858	325	235	482	1,111	1,544	1,232
Totals	142,296	123,584	207,361	217,542	192,701	159,347	192,816	271,931	272,519	272,400

* Prior to 1948, Molasses used for cleaning ferment was included with that shown under heading "Other Purposes."
† Supplied by Government Statistician.

Table A

Summary of production and consumption figures and sugar values for ten years

Year	Total Sugar Production at 94 n.t.*	Total Sugar Exported at 94 n.t.	Average Australian Price	Average Export Price	Average Price No. 1 Pool Sugar	Average Price all Sugar	Total Value
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£
1945.. ..	644,624	205,453	21 18 0	16 17 9	20 8 2	20 6 1	13,087,000
1946.. ..	512,035	72,578	21 18 0	21 10 0	21 16 11	21 16 10	11,184,000
1947.. ..	571,503	95,246	24 0 0	29 12 6	24 16 0	24 18 9	14,251,000
1948.. ..	909,896	440,814	23 1 0	28 2 0	24 17 0	25 9 11	23,198,000
1949.. ..	896,236	431,254	24 6 0	29 7 6	26 9 3	26 14 10	23,967,000
1950.. ..	879,689	395,151	24 11 0	32 16 6	28 4 1	28 5 4	24,866,000
1951.. ..	704,043	154,486	33 14 0	36 15 6	34 7 4	34 7 6	24,201,478
1952.. ..	934,226	471,008	44 3 0	41 2 0	42 14 2	42 12 3	39,809,705
1953.. ..	1,220,025	730,566	47 18 6	39 18 0	43 8 3	42 7 11	51,723,936
1954.. ..	1,300,844	784,451	47 1 0	37 8 0	42 9 11	41 4 7	53,632,714
1955.. ..	1,135,331	624,521	46 18 0	38 11 6	42 14 2	42 6 5	48,048,154

* Excluding Local Sales.

Table B

Table of Mill Peaks (Tons of 94 n.t. Sugar)

Mill	1929	1939	1949†	1950†	1952	1953	1954	Best Year's Output
Mossman	14,972	20,000	22,000	22,000	24,000	31,000	31,000	32,102
Hambledon ..	31,836	36,000	39,600	39,600	41,000	44,000	44,000	52,298
Mulgrave	31,643	36,000	40,100	40,100	40,500	47,500	47,500	49,710
Babinda	31,901	36,000	39,600	39,600	42,500	46,000	46,400	42,070
Goondi	27,034	29,500	32,400	32,400	34,500	38,000	38,000	39,243
Mourilyan ..	23,630	27,000	29,700	29,700	31,000	34,000	34,000	35,412
South Johnstone ..	30,979	36,000	39,600	39,600	42,500	47,000	47,000	53,542
Tully	30,930	38,000	42,100	42,100	45,000	47,000	47,000	54,755
Victoria	32,221	37,500	43,600	49,100	52,000	78,000	82,000	89,353
Macknade ..	30,952	34,000	39,900	46,500	48,500	52,000	52,000	54,295
Invicta	11,736	16,000	18,300	19,100	20,500	30,000	30,000	28,538
Pioneer	21,391	26,000	30,100	34,000	35,500	45,000	45,000	59,045
Kalamia	26,053	31,000	35,400	35,600	38,000	48,000	48,000	59,698
Inkerman	*24,207	31,000	36,800	42,000	45,000	55,000	55,000	74,156
Proserpine ..	16,650	23,000	26,300	33,000	35,000	43,000	43,000	53,323
Farleigh	16,993	23,000	27,600	32,400	33,500	42,000	42,000	52,499
Racecourse ..	18,066	24,000	29,000	35,200	36,500	42,000	42,000	51,817
Pleystowe ..	19,871	24,000	29,200	35,900	37,000	45,000	45,000	52,922
Marian	18,997	24,000	28,600	32,300	33,500	42,000	42,000	47,981
Cattle Creek ..	8,791	12,000	13,400	14,100	14,500	20,000	20,000	21,953
North Eton ..	9,319	12,000	14,500	15,900	17,500	26,000	26,000	31,511
Plane Creek ..	18,233	24,000	28,600	30,800	32,500	42,000	42,000	53,531
Fairymead ..	15,882	21,000	25,700	28,600	29,500	37,000	37,500	37,740
Qunaba	8,940	10,000	11,200	12,700	13,500	15,500	§16,500	18,156
Millaquin ..	14,443	19,000	24,100	29,600	31,000	35,000	§39,000	40,429
Bingera	17,864	23,000	27,800	31,000	31,500	37,000	37,000	41,808
Gin Gin	6,000	6,500	8,000	8,400	9,000	12,500	13,000	12,147
Isis	28,011	27,000	30,000	30,200	31,500	33,000	35,000	41,325
Maryborough ..	3,862	7,500	9,500	9,500	‡17,300	14,500	20,000	16,378
Mount Bauple ..	6,231	6,500	7,200	7,200	—	—	—	—
Moreton	11,586	14,000	16,000	16,000	16,500	20,000	20,000	18,644
Eagleby	280	300	—	—	—	—	—	—
Rocky Point ..	2,014	2,200	2,700	2,700	2,780	3,500	4,000	3,117
	611,428	737,000	848,600	916,900	963,080	1,152,500	1,170,900	—

* Increased by 2,500 tons in 1938.
† Does not include 3 per cent. for Soldiers' Settlement.
‡ Includes 4,800 tons for Mt. Bauple.
§ As from 1955 season 2,000 tons peak was transferred from Millaquin to Qunaba.

Division of Soils and Agriculture

(L. G. Vallance, Assistant Director)

ANALYTICAL WORK

Soil Analyses for Fertilizer Advice

Fertilizer and liming recommendations were forwarded to growers in connection with 1,523 soil samples taken from farms in all districts. This represented an increase over the number of similar samples analysed the previous year. In addition, 163 soils were analysed from experimental plots of various types. Once again, particularly in the more northern areas, potash deficiency was more marked than that of phosphate. The accompanying table shows the percentage of samples at low, fair and good fertility levels of phosphate and potash. It also records the number of samples received from each district.

In addition, 169 samples consisting mainly of plant material were analysed, making a total of 1,855 samples handled by the Brisbane Laboratory during the year.

District	Phosphate			Potash			No. of Samples
	Low	Fair	Good	Low	Fair	Good	
	%	%	%	%	%	%	
Mossman-Babinda	29	12	59	52	27	21	168
Innisfail	27	14	59	61	19	20	176
Ingham	37	19	44	40	35	25	262
Ayr	5	4	91	11	1	88	57
Mackay	61	15	24	78	13	9	430
Bundaberg	48	18	34	59	16	25	323
Southern	56	15	29	55	17	28	107
Totals	44	15	41	58	20	22	1523

FERTILIZER TRIALS

It was again necessary to curtail somewhat the number of farm fertilizer trials because of the pre-occupation of the field staff with disease control work. Nevertheless, several very useful trials were harvested and the results will be of value in assisting growers to utilise fertilizer as beneficially and economically as possible. A trial carried out on red volcanic soil at Green Hill showed that adequate potash application was necessary on this soil type. At Ingham the first fertilizer trial for very many years was harvested, a comparison being made of planting mixtures containing high nitrogen with the normal recommended practice in which the bulk of the nitrogen is applied as a top dressing. The results showed that the very real risk of sett damage involved in using the former mixtures was not compensated for by any increased growth or yield of cane. A trial on new land at Walkerston, Mackay, was of considerable interest in that a very substantial response to phosphate was obtained and none to potash. This is in direct contrast to the results now being obtained on the older lands, and lends some support to the remarks made in previous

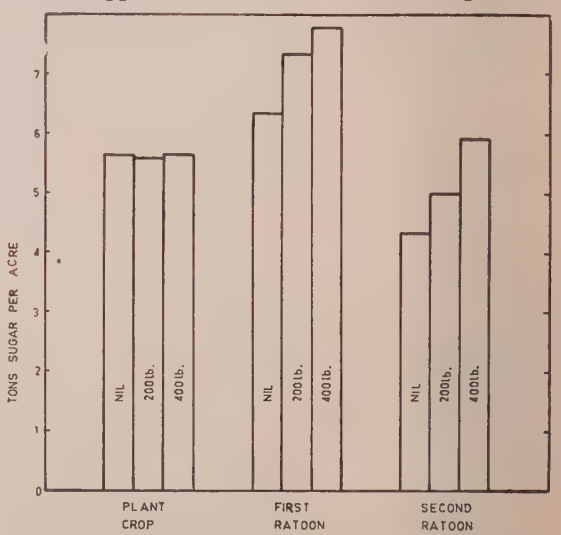


Fig. 13—Response to nil, 200lb. and 400lb. per acre of sulphate of ammonia on a red volcanic soil.

Annual Reports regarding the tendency over the years to over-fertilize with phosphate and under-fertilize with potash.

Nitrogen Response on Red Basaltic Soils

A factorial fertilizer trial completed its second ratoon crop on a red volcanic soil in the Isis area. The responses to sulphate of ammonia

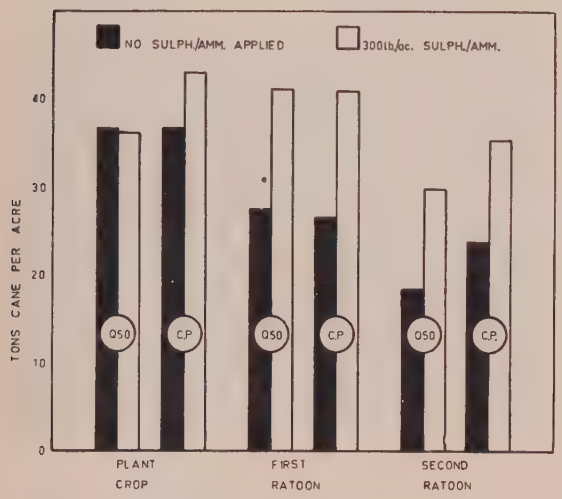


Fig. 14—Relative response of Q.50 and C.P. 29/116 to sulphate of ammonia in plant, first ratoon and second ratoon crops.

applications obtained over the three crops (plant, first and second ratoon) were typical of this class of country in Southern Queensland, and because of this they are illustrated in Fig. 13. Plant cane growing on these soils shows practically no benefit from nitrogen applications, but in succeeding crops the response is appreciable, being usually greater in the second ratoon than in the first.

The Varietal Factor in Nitrogen Requirement

A comparison of the nitrogen requirement of the varieties Q.50 and C.P.29/116 was finalised with the harvesting of the second ratoon crop of a trial on Bundaberg Experiment Station. Before the experiment was commenced in 1952 an attempt was made to deplete this red volcanic soil, as far as possible, of available nitrogen by growing Sudan grass just prior to planting. The behaviour of the two varieties in relation to nitrogen application for each crop is shown in Fig. 14. In both ratoon harvests their responses to sulphate of ammonia were identical. However, there was a significant difference in the plant cane, and while Q.50 was able to obtain all of its requirement from soil nitrogen, C.P.29/116 made a further growth of five to six tons of cane per acre when 300 lb. of sulphate of ammonia was applied. These two canes are the most important varieties in the southern area, therefore their nutritional characteristics are of considerable practical interest. Other details of this rather comprehensive trial are given later in this report in the section dealing with the activities of the Southern Sugar Experiment Station.

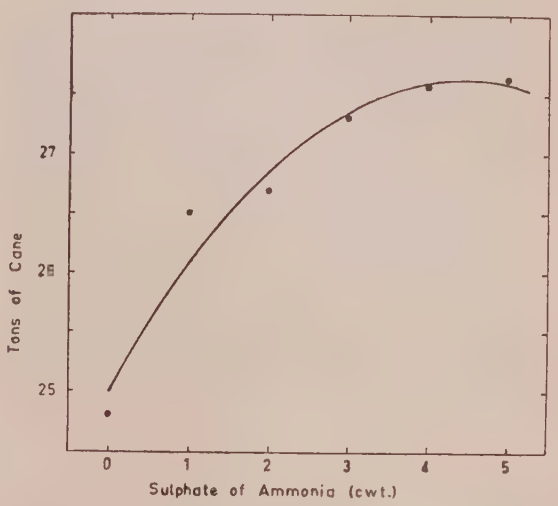


Fig. 15—The observed yields in tons of cane per acre are shown for the various amounts of sulphate of ammonia used. The curve, which shows the general relationship between yield of cane and sulphate of ammonia applied, represents the quadratic equation $y = 25.02 + 1.192x - .137x^2$ ***where*** y ***= tons of cane per acre and*** x ***= cwt. of sulphate of ammonia per acre.***

Nitrogen Response in Plant Cane

The harvest of a trial at the Central Experiment Station supplied some useful information regarding the nitrogen requirement of plant cane on a soil typical of a large portion of the Mackay district. Sulphate of ammonia was applied in one cwt. increments up to 5 cwt. per acre. The relation between yield and applied

nitrogen is shown in Fig. 15, and it is evident that the greatest response is between the 0 and 1 cwt. applications. The response per cwt. of sulphate of ammonia generally diminishes as the application is increased. In round figures the response curve indicates that the first cwt. of sulphate of ammonia brought about an increased yield of 1 ton of cane per acre, the second cwt. ¾ ton, the third cwt. ½ ton, the fourth cwt. ¼ ton, and the fifth cwt. nil. These results are in reasonable agreement with observations recorded from many fertilizer trials carried out under similar conditions since green manuring has become an almost universal farm practice.

MINOR ELEMENT TRIALS

Effect of Lime and Copper on an Acid Soil

An investigation of growth failure in a cane field at Bundaberg revealed that the soil was in an extremely acid condition. A series of field and pot tests was set out, and lime, in combination with various minor elements, was applied. With the better growth of the cane obtained in response to the lime applications, typical symptoms of copper deficiency immediately became obvious. These were indicated by well defined "droopy top," intervenal chlorosis and, in particular, green shadow spots on the leaf. In the pot trial, applications of copper either to the soil as copper sulphate, or to the leaves as a chelate spray produced normal and quite vigorous growth.

Field trials with the chelated copper spray have been laid out as this may prove to be a far more economical method of applying copper to deficient areas. One application of the spray which contains .009 per cent. copper is equivalent to 1/10 lb. copper sulphate per acre.

Copper deficiencies were reported from several areas during the year and some outstanding responses were obtained to the application of copper sulphate. Chemical analyses of the affected cane showed that the copper content of the leaf was generally below five parts per million.

Fig. 16—Copper deficiency symptoms on a very sandy farm at Mossman.

SUGAR AND CANE QUALITY STUDIES

Combined Boron and 2,4-D Applications in Southern Queensland

Following on the work started last year a field trial to test the effect of boron and 2,4-D on the maturity and sucrose content of cane was carried out at the Pathology Farm, Eight Mile Plains, during the year. In this trial—planted in March, 1955, cane was subjected to six treatments : (a) control, (b) borax top dressing 40lb./acre, (c) borax top dressing 20 lb./acre, (d) foliar spray containing 6.1 per cent. boric acid, (e) foliar spray containing 6.1 per cent boric acid and 6 p.p.m. 2,4-D, and (f) foliar spray containing 50 p.p.m. 2,4-D.

The two soil treatments were applied in spring (cane seven months old) and the sprays in April, 1956 (cane 13 months old). All foliar sprays were of the rate of 60 gallons per acre.

The analysis for brix, pol and reducing sugars when the cane was fifteen months of age showed there were no significant differences due to treatments in either sucrose content or maturity at the beginning of the 1956 crushing season. Regular samplings are being continued in case any differences occur in the mid or late season periods.

Leaf Applications of 2,4-D in Northern Queensland

Towards the end of March the sodium salt of 2,4-D was sprayed on the foliage of the variety Trojan in a randomised trial set out at Gordon-

vale. The concentrations used were 5, 50, 500 and 5000 p.p.m. The plots were sampled a month later and again about the middle of May. Brix determinations were made on both top and

Fig. 17—Slicing the soil cylinder in 2,4-D leaching experiments.

butt portions of the cane stalk, but it was not possible to detect any consistent evidence that the various treatments had affected the sugar content of the juice.

Further Experiments with Maleic Hydrazide

Following the work reported in Technical Communication No. 1, 1956, further trials were set out to investigate the effect of maleic hydrazide on the sucrose content of sugar cane. The original experiments indicated firstly that when maleic hydrazide was applied to young cane early in March the c.c.s. was increased by approximately four units some seven weeks later. Secondly, if the application was made at the commencement of the crushing when the cane was more mature, maleic hydrazide had no effect on c.c.s. Although the initial work did not indicate much prospect of commercial use it seemed desirable to investigate whether an application later in autumn might increase the c.c.s. of cane which, although sufficiently immature to be affected by maleic hydrazide, would be harvestable fairly early in the season.

Unfortunately the work was restricted by cyclone damaged cane but two trials in the Highleigh and Freshwater areas which were sprayed at the end of March showed no differences in juice quality due to the application of maleic hydrazide.

A third trial (Highleigh area) set out at the same time showed that the maleic hydrazide spray of 4.0 per cent. concentration significantly increased the brix reading of the top portion of the stalk, with a tendency to a decrease in the butt. However, this treatment brought about a very marked reduction in growth and a loss of some two feet of millable stalks. Concentrations of 1.0 per cent. and 2.0 per cent. had no recognisable effect on the juice.

An earlier plot at Highleigh was sprayed on 8th February, the treatments again being one, two and four per cent. maleic hydrazide. No increases in brix were obtained, but the two heaviest applications caused severe stunting in growth.

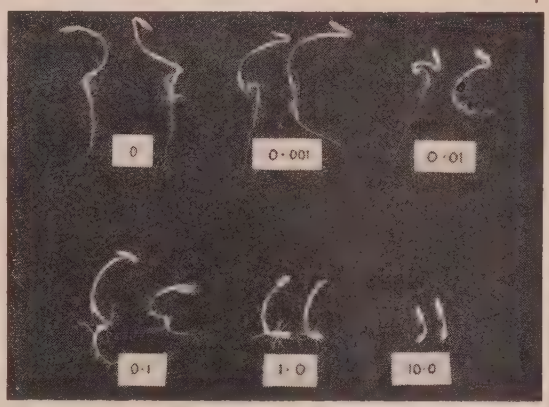


Fig. 18—Growth of cucumber roots as affected by 2,4-D in parts per million.

A considerable amount of time has now been given to this work, but unless more consistent results can be obtained it seems unlikely that maleic hydrazide has any practical value for increasing sugar content under normal farm conditions.

A Comparison of the Brix of Cyclone-damaged and Undamaged Cane

The variety Pindar was severely damaged during the cyclone which occurred in March. On Block E at the Northern Sugar Experiment Station approximately 80 per cent. of the stalks were decapitated, and this afforded the opportunity of comparing the brix values of damaged and undamaged stalks during the

ripening period. This comparison is shown in Fig. 19 where the brix values for both the top and butt sections are plotted over the period from the beginning of March to the end of June.

ments were made to compare the leaf area of undamaged cane with that of the newly developed side shoots from the top eyes to the broken stalks. It was found that the decapitated cane had made a new leaf surface which

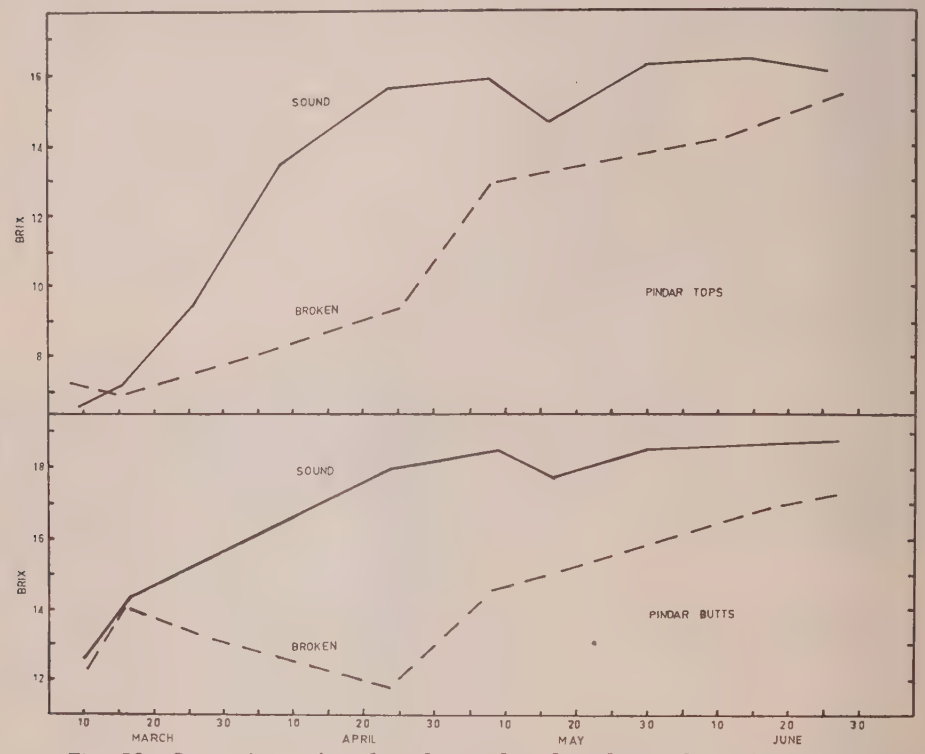


Fig. 19—Comparison of cyclone-damaged and undamaged Pindar. The brix values of the juice from top and bottom "halves" of both sound and decapitated stalks are shown for the period from the beginning of March to the end of June.

The undamaged cane showed the normal rate of rise with the butt section of the stalk at a higher sugar content and the top section climbing steeply to approach it as the cane matured. However, after the stalk was decapitated by the wind the sugar in the butt dropped and continued to decrease for six to seven weeks while the top section showed a steady rate of increase, although much slower than that of the undamaged cane. It was during this period that the upper eyes of the broken stalks began to grow and about three shoots rapidly developed.

Apparently the sugar in the butt was being translocated to the top section for use by the vigorously growing shoots. About 2½ months after the damage had occurred some measure-

was a little over half the area of that of the unbroken cane.

As will be seen from the graph, from the end of May onward the brix of the damaged stalk began to approach closely that of the normal cane.

Although the variety Q.57 was not decapitated by the cyclone it was of interest from a varietal point of view to conduct an experiment by mechanically removing its top for comparison with the much more wind-susceptible Pindar. The behaviour of the two canes was essentially similar. A noticeable feature with regard to Q.57 was the more extensive side-shooting and the consequent greater decrease and slower recovery of brix of the butt sections.

The opportunity was also taken to observe the behaviour of the various plots of a nitrogen-phosphate-potash fertilizer trial on a block of Pindar which had been extensively damaged by the wind. As might be expected greater breaking occurred in the taller cane of the nitrogen plots, and it was of interest

Fig. 20—Delegates to the Cane Pest and Disease Control Boards Conference examining Giant Sensitive Weed on a South Johnstone cane farm.

to note that side-shooting occurred relatively uniformly over the whole trial and was apparently not affected by the amounts and types of fertilizers which had been applied.

Refractometer Brix vs. Pol for c.c.s. Calculation in Varietal Selection

These studies were initiated in order to investigate the possibility of substituting hand refractometer brix readings for the more time-consuming c.c.s. determinations, mainly for use in varietal selection work. If a workable correlation could be found to exist, the advantage of the more rapid method is obvious, particularly since it would be possible to make a far greater number of determinations, thus reducing the sampling error. A large number of comparisons of c.c.s. calculations was made using hand refractometer brix, spindle brix, and pol from available records over a number of years from the Northern, Central and Southern Sugar Experiment Stations. The figures which have been statistically analysed to date seem to indicate that a c.c.s. value using an estimated figure for pol based on the actual brix reading would vary within the limits of ± 1.7 units of c.c.s. This range is rather wide for practical applications but it is possible that a more detailed examination of the available records might reveal a correlation that would be useful for a considerable amount of the seedling selection work.

For instance, the c.c.s. of a plot of Pindar (1 chain x 6 rows) was estimated by taking 75 separate samples each composed of six stalks. By using the standard method, i.e., the direct estimation of pol, it was found that the variation in c.c.s. within the plot ranged from 15.6 to 17.5. When the pol was calculated from the spindle brix the range was 15.7 to 17.3, which for all practical purposes is the same.

Unfortunately in using the hand refractometer there are a number of factors which must be taken into account and which have been shown to exert a considerable influence on the brix reading, i.e., the position in the stalk from which the sample is withdrawn and the temperature of the hand refractometer itself.

Fig. 21—Flood damage on a Herbert River farm in early 1956. Note suspended trainline and eroded crop-land.

The issue of this work is, as yet, by no means clear, but in view of the known difficulties of obtaining a representative sample of a block of cane it is worthwhile pursuing the possibility of using rapid methods to test a larger number of samples even at the sacrifice of some accuracy in the estimation of c.c.s.

Weekly Measurements Indicate Tendency to Over-water

As in the previous year, regular soil moisture sampling was carried out on a number of farms in order to investigate to what extent farmers

Fig. 22—The difficulties of using cyclone-bent cane in a cutter planter.

endeavoured to maintain a definite moisture content in their soils. Eight blocks on seven different farms were selected as test areas, and on these the period of application of water varied from once per week to once per fortnight.

It was found that, in general, the irrigation routine practised was sufficient to maintain soil moisture at an adequate level. Where long runs were used to distribute the water, irrigation was often excessive. In other cases, where light waterings were given, wetting occurred to a depth of about 12 inches only. A Parshall flow meter is being constructed so that more accurate measurements of the volume of water applied may be made.

Range of Available Moisture

The moisture at wilting point was determined using the pressure membrane apparatus and also the sunflower method. Reasonable agreement was obtained between the two methods. Field capacity moisture was estimated from the moisture equivalent and the values so obtained were used to calculate the range of available moisture in three fairly typical Burdekin soils. It would appear that when these soils are wetted to their normal field capacity they contain approximately 18 per cent. moisture, of which a little over half is available to the cane plant.

Lime Applications Increase Rate of Water Infiltration

A set of ring infiltrometers was used in a series of investigations designed to measure the rate of penetration of irrigation water. It was found that an appreciable increase in penetration rate occurred when lime was applied to several soils which were normally difficult to irrigate. In these tests lime was used at the rate of four and two tons per acre and in general the heavier application brought about a greater beneficial effect. A considerable amount of rain fell during the tests, and most of the

Fig. 23—A fine crop of Q.57 at Scrubb View, Ingham Line.

measurements were made under wet soil conditions instead of the normally drier circumstances which occur at the commencement of irrigation. However, there is little doubt of the beneficial effect of liming on these soils.

It was also possible to compare penetration rates on a soil which had received molasses, some three months previously, with those on an adjacent untreated area. Although the measurements were made in rainy weather and reliable quantitative figures were difficult to obtain, moisture penetration on the molasses area was roughly twice as fast as that on the untreated soil.

These experiments are being continued and extended to include measurement of the effect of green manuring on irrigation water penetration.

NITROGEN CONTENT OF CANE IN RELATION TO YIELD

From time to time there have been references in overseas literature to what has been called the Inverse Yield Nitrogen Law which, in effect, claims that a low nitrogen content is an inherent characteristic of a high yielding variety and vice versa. If such were the case the estimation of the nitrogen content of a seedling or new variety would be a useful factor in determining its probable yield. An experiment was designed at Meringa to test whether this concept had any practical application in our seedling selection programme.

One of the standard Yield-Observation trials was used to provide the necessary data and the varieties investigated were Pindar, P.O.J.3016 and four seedlings (L.620, L.623, L.675, 38S.N.473). The cane was weighed at harvest and c.c.s. and N determinations were made. The results did not indicate any relation between nitrogen content and yield of millable cane or sugar.

A point of interest arising from the numerous nitrogen estimations made was that non-arrowed stalks contained a higher percentage of nitrogen than arrowed stalks.

Northern Sugar Experiment Station

G. Bates, Officer-in-Charge

Weather and Crop Notes

The soil was in good condition for the young crop at the beginning of the 1955-56 season. Rainfall for July and August was under average, but in September, October, and November more than twice the average was recorded for these three months. This kept the young cane growing strongly until December, and although the 210 points which fell in that month was only half of that usually received, the cane did not suffer a check; it then appeared that the 1956 crushing would be a record one. January yielded 18.53 inches (above average) and February 13.96 inches (below average). At this period prospects for the 1956 season were bright and the crops in the Cairns district were the best for many years. However, on March 6th the cyclone "Agnes" hit this area and did an enormous amount of damage. Wind velocities up to 100 m.p.h. were experienced and crops were wrecked. The variety Pindar suffered spectacular damage, whole fields being broken off at the growing point. The cane shot from the three top eyes making a new canopy, and any crops having reasonable length of stalk at the time of the blow eventually became harvestable. Those crops with only a couple of feet of cane were a complete loss. Other varieties suffered varying amounts of damage and, although Q.50 was not decapitated, it was blown about, tangled and suffered stalk breakages at the butt. Some of these fields will present a harvesting problem. The new variety Q.57 stood up better than others and has gained much favour because of this characteristic. The remarkable point about cyclone "Agnes" was the absence of torrential rain with subsequent flooding which usually accompanies these cyclonic blows. Only three points of rain fell on the night of March 6th, although the sky was completely overcast. Twenty-four points were registered on the 8th

Fig. 24—At Meringa Experiment Station early in the cyclone. Later the house on the right lost its roof.

and 9th and 21 points on the 15th. Heavy rain did not fall until the six days ending 26th March when 15.25 inches were recorded. This caused local flooding and gave a precipitation of slightly over average for the month. April-June inclusive rainfall was slightly under average and was ideal for autumn planting. Farmers were thus able to get the greater portion of their plantings completed prior to commencement of the crushing season.

The damage from the cyclone to experimental plots of new varieties was serious and much of the varietal work will be set back for twelve months.

Fig. 25—Applying BHC deep in the drill at Meringa for control of frenchi.

Damage to station buildings was considerable. The large glasshouse was wrecked so badly that it will have to be replaced. The roof was blown from the large residence and a garage was completely demolished. Minor damage was done to other buildings and power lines were brought down. Many of the large trees in the garden, including coconut palms, were blown down.

1955 Plantings and Germinations

Early plantings for the 1956 crop, known as "autumn plant," were well below normal, due to heavy rain in May, 1955, which delayed land preparation particularly in the wetter areas. Good germinations were the rule.

Later plantings, which are referred to as "spring plant," also gave good germinations. With the widespread use of mercurial dips and sprays poor germinations are now rarely recorded. With adequate soil moisture crops made rapid growth and at the time of the cyclone looked better than in any other year.

In contrast with the 1955 crop the plantings for 1956 harvest received more or less normal fertilization in most instances. The use of plants free from ratoon stunting disease greatly helped in the growing of better crops.

1955 Harvest

The 1955 harvest was again a somewhat difficult one but was an improvement on the previous year. Again there was a shortage of cane cutters and this, combined with inexperienced labour, contributed to high cutting costs.

Pests

During 1956 greyback grubs caused negligible damage in Mossman, Hambledon, and Mulgrave, but over 100 tons of cane was lost in Babinda on fields not treated with BHC. Frenchi grubs were responsible for losses of 1,500 tons in Mossman, 160 tons in Hambledon, and 300 tons in Babinda; no loss was observed at Mulgrave. Other insect pests were of negligible importance, but it is of interest that in Hambledon the incidence of beetle borer was slightly greater than in recent years.

The final estimate of rat damage in the 1955 crops in the four most northerly mill areas, Mossman to Babinda, amounted to 17,500 tons. It is anticipated that the loss during 1956 will be very much less. Wallabies were not an important pest, the maximum loss in one mill area amounting to 100 tons, at Babinda; pigs destroyed over 1,000 tons of cane.

Unidentified native fauna attacked mature cane stalks where cane fields abutted on rain forest, causing considerable damage on portions of fields; this type of damage is most frequently observed at Mossman and Babinda.

1956 Planting Conditions for 1957 Crop

Rainfall for the year 1955-56 was 71.91 inches, compared with the 32 year average of 75.71 inches. This is well below the 99.81 inches recorded in the previous crop year, but approximates the average. The rainfall for the six months January-June, 1956 (inclusive) was

about average. April, May, and June rainfalls were below average, which allowed growers to prepare land and get the biggest percentage of their planting done during the autumn. Germinations generally have been good, although slow where plantings were made during the cold weather in June. Hours of sunshine during the planting period have been a little more than during the previous two years and this has helped germinations.

The following tables show the rainfall records taken at the Northern Sugar Experiment Station over the past 32 years and include details of other meteorological observations:—

Rainfall Records, 1914-1956

Year	Rainfall in inches	Year	Rainfall in inches
1924-25	82.86	1940-41	80.59
1925-26	49.02	1941-42	41.55
1926-27	80.34	1942-43	64.60
1927-28	72.46	1943-44	52.92
1928-29	92.83	1944-45	120.34
1929-30	69.99	1945-46	63.95
1930-31	75.62	1946-47	35.24
1931-32	61.87	1947-48	69.12
1932-33	90.02	1948-49	85.77
1933-34	119.09	1949-50	83.50
1934-35	58.22	1950-51	67.68
1935-36	87.64	1951-52	52.86
1936-37	49.54	1952-53	83.98
1937-38	53.28	1953-54	68.15
1938-39	126.79	1954-55	99.81
1939-40	82.10	1955-56	71.91

Average for 32 years: 74.80 inches.

Abstract of Meteorological Observations made at Northern Sugar Experiment Station, Gordonvale, from 1st July, 1955, to 30th June, 1956.

Month	Rainfall in Inches	Average Rainfall in 32 Years	No. of Wet Days	Shade Temperature						Mean Diurnal Range	Mean Temperature 9 a.m.	Mean Per Cent. Relative Humidity 9 a.m.	Average Daily Hours Sunshine	
				Maximum			Minimum							
				High	Low	Mean	High	Low	Mean					
1955													hr.	min.
July ..	0·19	2·04	7	87	69·5	79·65	67	52	60·85	18·80	69·03	90·4	3	57
Aug. ..	0·41	1·05	2	90	76	84·26	67	48	57·98	27·28	70·42	88·0	7	00
Sept. ..	2·04	0·97	14	93	76	83·48	67·5	52	61·20	22·28	72·85	87·0	6	34
Oct. ..	3·03	1·21	9	99	80	90·89	73	55	66·08	24·81	79·78	81·3	7	40
Nov. ..	4·77	1·59	12	92·5	77	88·62	73	61	67·72	20·90	79·93	80·5	7	58
Dec. ..	2·10	3·06	13	98	82	91·70	77	62	70·26	21·44	80·92	80·0	9	04
1956														
Jan. ..	18·53	15·54	25	99·5	82	89·20	76	70	73·24	15·96	79·66	88·3	4	23
Feb. ..	13·96	19·67	20	99	85	92·08	76	68·5	71·64	20·44	81·20	86·5	6	35
Mar. ..	17·86	15·23	18	95·5	81	87·98	77	51	70·67	17·31	79·12	84·3	5	10
Apr. ..	5·80	6·20	15	88	79	84·76	73	62	67·46	17·30	76·81	88·7	5	20
May ..	1·69	2·64	8	91	78	82·42	74	63	66·03	16·39	73·53	89·9	6	12
June ..	1·53	2·08	10	85	73	79·45	70	43	60·75	18·70	69·70	85·0	5	14

EXPERIMENT STATION OPERATIONS

Seedling Raising and Selection

In conformity with usual practice fuzz was planted in the glasshouse in late July and a grand total of approximately 23,294 seedlings were planted in the field during October. These consisted of 7,894 spaced seedlings with 1,540 bunch plantings representing approximately 15,400 seedlings.

The field selection of the 1954 series original seedlings resulted in 1,890 being planted out; 1,460 of these went into 4-sett plots, 360 into 2-sett plots from bunch plantings, while 78 seedlings were selected for breeding purposes.

Fig. 26—Original seedlings being loaded for milling.

Progressive Seedling Trial

A replicated yield observation trial having four randomised blocks of each variety was planted in 1955. This consisted of 19 "N" series canes, one "L" series and one "M" series and also included I. 106, an advanced seedling selection from Mackay, and the following introductions from overseas: H 35-198, H.40-1184, H.44-2363 and C.P.43-47.

New Varieties Imported

Twenty-four new varieties were introduced to this Station during 1955 for cross-pollination work and trial as commercial canes. These were: R.P.8, D.74, C.P.1165, 52 B.N. 1761, 52 B.N. 1764, Cl.41-223, B.34-39, I.225, I.423, L.469, M.421, Q.61, Q.62, H.25, C P.51-27, I.102, I.106, Co. 285, Co. 312, Ebene 1/37, P.R. 1000 and 51 B.N. 15802.

Fig. 27—Cercospora damage in velvet bean. Meringa, February, 1956.

Experiments Harvested during the Year

Five seedling trials were harvested during the year. These consisted of a plant trial in the form of a Latin square, a first ratoon randomised block, two plant yield observation trials and a ratoon yield observation trial.

In the plant Latin square trial the varieties K.646, K.675, K.690, and K.728 were compared with the standard variety Pindar. The trial was harvested at twelve months. Yields in tons of sugar per acre were:—

Pindar (standard)	5.41
K.690	4.93
K 675	4.60
K.728	4.41
K.646	4.17

The standard variety Pindar was significantly better than all others at the 5 per cent. level. The trial is being carried on to the first ratoon crop.

In the ratoon randomised block where the varieties Co. 475, J.204, J.238, J.330 and J.301 were compared with Pindar, and the crop was harvested at twelve months, the Co. 475, with

Fig. 28—Control of crowsfoot grass (Eleusine indica) with maleic hydrazide. Left, sprayed with 0.5 per cent. maleic hydrazide. Right, unsprayed..

six tons of sugar per acre, was significantly better than the standard Pindar. Details of tons of sugar per acre in the first ratoon crop are:—

Co. 475	6.00
Pindar	4.18
J.238	3.13
J.204	2.83
J.301	2.72
J.330	2.56

Over the two crops the total yield of sugar per acre was:—

Co.475	13.53
Pindar (standard)	10.72
J.238	7.74
J.204	7.48
J.301	6.78
J.330	6.68

The performance of Co. 475 is outstanding but, as stated in last year's report, the variety is highly susceptible to red rot and its reaction to this disease in North Queensland is being closely watched. If it does not succumb to the disease then the variety will be a definite asset on the poorer lands.

In the plant yield observation trial 28 "M" series canes were compared with Pindar. There was no outstanding variety, practically all yields of sugar per acre being below that of the standard. The trial will be harvested again in 1956 as a first ratoon crop.

In the other plant yield observation plot the following varieties were compared with Badila to endeavour to select canes suitable for rich land: Q.57, Q.64, I.233, K 622, K.628, K.641, K.657, K.696 and K.717. Of these Q.57, I.233 and K.641 showed to advantage. It is hoped the variety I.233 will serve a purpose in flooded land or land where other canes lodge and have low sugar. The main attribute is that it stands up under all conditions and is very resistant to wind damage. However, it is susceptible to leaf scald and chlorotic streak disease, as well as being an indifferent ratooner. Yields of sugar per acre were:—

K.658	7.84
Q.64	7.33
K.657	7.15
Q.57	7.08
K.696	6.95
K.717	6.83
K.641	6.13
Badila	6 18
K.628	5.95
K.622	5.65
I.233	4.83

In the first ratoon yield observation plot the "L" series seedlings failed when compared with Pindar.

Ratoon Stunting Disease Investigations

During 1954 a time temperature trial was laid out to obtain further information on ratoon stunting disease. Four varieties, Badila, Trojan, Pindar, and Q.59 were subjected to hot water treatment for various times at different temperatures. In addition, both "thick" and "thin" plants of each variety were used to determine whether or not thickness influences the degree of the curative effect achieved with each time/temperature combination.

Control of Ratoon Stunting Disease and Hot Water Treatment

Measures for the control of ratoon stunting disease were continued, and after investigations showed that the two-hour treatment at 50° could not be relied upon to give 100 per cent. cure in all varieties; a two-acre block was set aside and planted to varieties which were treated at three hours at 50°. In all, 460 varieties were

Fig. 29—Little leaf disease of velvet bean, March, 1956. Top, virus affected leaves, and bottom, normal leaves.

so treated and as most of these were from stocks previously hot water treated it is felt that our planting material should now be free of ratoon stunting disease.

Legumes

Legume varieties totalling about 100 have been introduced to the Station during the year. These include cowpeas, velvet beans, and a number of different species from the Commonwealth Scientific and Industrial Research Organisation. The most promising include *Dolichos lab-lab*, *Phaseolus mungo*, *Phaseolus aureus*, and *Phaseolus* sp. Nine have been selected for further trials. Those found to be unsuitable for green manure crops include *Sesbania* sp. *Phaseolus aconitifolius*, *Cyamopsis psoraloides*, and *Dolichos biflorus*.

Thirteen varieties of velvet bean from South Africa have been tested against the standard variety. Most were slightly superior to the

standard, while Somerset Strain No. 1 appeared the best. A slight difference in their susceptibility to *Cercospora* leaf spot was found and the variety "velvet mottled" was the most resistant. Six velvet beans were selected for further trials from the seventy-three single plant selections from Bundaberg.

The cyclone afforded the opportunity of studying the resistance of various varieties to wind damage. *Phaseolus aconitifolius* was highly resistant, while *Dolichos lab-lab, Vigna sinensis Dolichos biflorus*, and *Phaseolus mungo* showed some resistance. Susceptible varieties include *Phaseolus radiatus* and *Phaseolus aureus*, while *Cyamopsis psoraloides, Sesbania* sp. and *Stizolabium deeringianum* were highly susceptible.

Further plantings of the promising cowpeas, C.P.I.11044 (Malabar pea) and C.P.I.12377 (Black Eye), have shown that they are equal to Reeves Selection on a number of soil types in Babinda and Mulgrave areas. As no wilt showed in the plots of Reeves Selection, no comparisons could be made as to their resistance to this disease.

Annual Field Day

Owing to the damage done to crops and Station Buildings by cyclone "Agnes," Field Day was abandoned in 1956.

Laboratory Work

The following is a summary of cane samples handled during the year:—

Station and trial samples ..	800
Farmers' samples	66
	866

Summary of Crops Grown on the Station

	Tons
Parent canes and trials, used and sold for plants and c.c.s. samples ..	515.49
Original seedlings	83.575
	599.065
Plant cane harvested for the Mill, including that sold for plants ..	342.315
Ratoon cane harvested for Mill ..	217.750
Plants for Stations and other experimental plantings	31.000
C.c.s. samples and crossing work ..	8.000
	599.065

Area plant cane harvested ..	13.0 acres
Area ratoon cane harvested ..	8.0 acres
Tons per acre	28.52 tons

Lower Burdekin Sugar Experiment Station

G. A. Christie, Officer-in-Charge

Weather Conditions and their Effect on Crops in the District

After the unusually large amount of rain in May, 1955, normal dry conditions prevailed for the remainder of the year, the last six months of 1955 yielding 1.47 inches of rain on eight wet days. Dry weather in this period permitted the removal of the 1955 crop without interruption and allowed cultivation and irrigation operations to proceed normally for the production of the 1956 crop.

Early January, 1956, brought the start of a long wet season which yielded a little over the annual average rainfall on a greater than normal number of wet days. The total precipitation for the year ending 30th June, 1956, was 48.38 inches registered on 89 wet days and 35.47 inches of this fell during the first three months of 1956 on 61 wet days. After the end of March rain became more intermittent, but was spaced at regular intervals, thus keeping cane soils in a semi-wet condition for a long period, delaying preparation of land and permitting the planting of approximately 40 per cent. of the area normally planted in autumn.

An intense cyclonic disturbance passed to seaward in a north-westerly direction on 3rd March, and the lowest corrected barometric pressure of 28.652 inches was recorded when wind velocity was estimated at over 70 miles an hour. Advanced crops lodged while extensive breakage of tops of the brittle variety Pindar occurred on many farms in the area. Very little rain fell at the time, and a period of showery weather, followed by clear days provided ideal conditions for recovery of crops from the damage, and losses may generally be regarded as light, except where broken cane prevented further stalk elongation. Cyclonic winds provided an excellent opportunity to assess the effects of strong wind on many new seedling varieties, and the resistance to lodging or stalk breakage has been recorded for future reference.

Germination in the limited area of autumn plant cane was generally very satisfactory throughout the area, and the benefits obtained from the pre-planting treatment of setts with fungicidal solution under wet soil conditions are appreciated by cane growers of this district.

With such a prolonged wet summer, heavy arrowing would normally be expected. Much of the rain, however, fell during the hours of darkness, and broken cloud by day only slightly reduced the hours of sunlight. Light arrowing which has followed will permit stalk elongation in late maturing varieties.

An abstract of meteorological observations at this Station for the year 1st July, 1955, to 30th June, 1956, follows:—

Month	Rainfall (Inches)	No. of Wet Days	Shade Temperature						Mean Diurnal Range	Mean Temperature 9 a.m.	Mean Per Cent. Relative Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1955											
July	·05	1	82	64	76·5	68	44	54·5	22·0	66·06	74·2
August	—	—	90	74	82·2	62	43	53·5	28·7	69·3	68·9
September ..	·3	1	89	78	83·8	67	52	58·2	25·6	74·9	64·7
October	—	—	101	83	88·6	74	56	67·6	21·0	81·4	63·3
November ..	·45	3	95	83	90·7	75	60	65·9	24·8	81·7	62·5
December ..	·67	3	100	90	93·2	80	60	69·9	23·3	85·9	57·7
1956											
January ..	13·09	21	102	79	88·2	78	62	72·0	16·2	80·18	81·5
February ..	7·52	16	98	82	90·2	84	70	74·0	16·2	81·2	84·0
March	14·86	24	97	82	87·9	75	66	71·2	16·7	79·7	80·2
April	3·03	7	90	78	86·0	71	54	65·9	20·1	76·8	80·7
May	5·04	8	89	74	·82·2	70	51	62·4	19·8	72·1	78·8
June	3·64	5	86	69	77·3	63	41	52·7	25·6	63·6	79·2
Totals ..	48·38	89									

Entomological Notes

Most of the area normally affected by white grubs had been treated with BHC and an effective control has been obtained following heavy beetle flights early in January. Some spot damage is apparent in some fields not treated with the insecticide but losses in the district's crop are expected to be small. The giant termite (*Mastotermes darwiniensis*) was responsible for small crop losses in some localities while destruction of setts by this insect resulted in "misses" occurring in some patches of newly planted cane. Slight damage by coots in areas adjacent to lagoons is visible, while a small loss from wallabies is noted in areas adjacent to grazing land. Rat damage was somewhat greater in the crop for 1955 harvest than is normally experienced in the Burdekin and Giru areas. Soft, high sugar varieties which had lodged were mainly affected.

Ratoon Stunting Disease

Planting material from stocks hot water treated for two hours at 50° C. has been used extensively throughout the Lower Burdekin and Giru areas, and Cane Pest and Disease Control Boards are making rapid progress in propagating and distributing plants treated for three hours at 50° C. in order to control this disease. Excellent germination and early growth of plant cane and good ratoon stands are noted on most farms where treated plants were used, and cane growers are co-operating readily in the use of these plants.

Chlorotic Streak Disease

Symptoms of this disease were located on two farms in the Giru area late in June, 1956, and steps to ascertain the extent of infection were undertaken immediately. Examination of cyclone damaged mature cane has presented difficulties, but when the extent of infection has been ascertained, control measures will be instituted. The symptoms were detected in several fields of the variety Trojan on one farm, while S.J.16 on an adjacent farm also showed the presence of this disease.

Other Diseases

The treatment of setts with fungicidal solution is now adopted as a standard procedure in planting operations on almost every farm in the area, and pineapple disease has ceased to affect the germination of plants. Farm inspections have located a few stools of mosaic disease, and in the near future it is hoped that a complete elimination of this disease will be achieved.

Fig. 30—Q.57 on the Sugar Experiment Station. Planting material was treated at 50° for three hours.

Specimens of what appear to be minor complaints have been submitted for pathological examination.

EXPERIMENT STATION OPERATIONS

Seedling Raising

Cane fuzz produced at the Northern Sugar Experiment Station was sown in the Station glasshouse on 2nd August, 1955; 6,240 of the seedlings produced (the progeny of 56 bi-parental combinations) were transplanted to the field and, when examined in June, 1956, 142 were selected for planting in 40 sett plots. A high percentage rate of selection was observed in crosses where Trojan and Vidar were used as female parents, indicating that these two varieties might be used more extensively in seed production for the Lower Burdekin area.

Seedling Trials

A total of 208 new varieties were planted in 40 sett plots in July, 1955, these comprising 174 seedlings raised on this Station, and 34 introduced from other districts or other countries. Many suffered cyclone damage in breaking or lodging and, in June, 1956, 27 were selected for inclusion in a replicated yield observation trial, while six others will be replanted in 40 sett plots. Some of the vigorous, thinner canes introduced from other districts were unsuitable for the irrigated soils on this Station, but their performance elsewhere suggests that they may prove satisfactory on low cropping soils or unirrigated farms in the area.

Selected varieties planted in their yield observation trial in July, 1955, included 18 Burdekin seedlings and eight from other districts. In the plant crop some are comparing favourably with standards in the trial and selections from this trial in 1957 will be based on yield and c.c.s. figures from the plant cane together with notes on the ratoon crop.

On harvesting the plant crop of the yield observation trial which was planted in 1954, it was found that many of the new canes were superior to the standard S.J.16, but the other standard in the trial, Pindar, produced the highest tonnage of sugar per acre. The variety Ragnar also yielded well, but because of its thin though vigorous stalks, it may not find a place on the high producing soils of the Burdekin. Observation plots with this variety are being established on areas of lower production where its value will be assessed. Based on their performance in the plant crop and on their ratoon growth four "N" series seedlings were selected for inclusion in the randomised block trial to be planted this year. It is of interest to record that all four selected canes (N.434, N.435, N.446 and N.449) are progeny of the cross Trojan x Q.36. One section of the trial received unsatisfactory growing conditions and varieties from the area in question were again included in the planting of the 1955 yield observation trial.

Of the four "M" series seedlings (M.415, M.421, M.441, and M.456) planted in the randomised block in July, 1955, only one, M.421, may be worth planting on district farms for further trial. This Trojan x Q.32 seedling shows high sugar content when harvested in the middle of the crushing season, and while its crop may be a little less than standard varieties, the return in sugar per acre would be of the same order as commercially grown varieties.

Some soil irregularity and adverse growing conditions rendered the randomised block trial planted in 1954 of doubtful value. While all new canes were superior to S.J.16, they did not measure up to Pindar, the other standard in the trial. Two "L" series seedlings (L.423 and L.469) were included in this trial and, in 1955, both were planted in observation plots on 12 farms in the district. The former, although a light stooling variety with only fair cover, produces thick, very heavy stalks. L.469, on the other hand, has many desirable agricultural features, and while it may not be as vigorous as some standard canes, its comparatively high early sugar content and resistance to lodging even under cyclonic conditions, may give it a position in the district varietal list.

Fig. 31—The variety L.469 on the Experiment Station. The crop is 9½ months of age, estimated at 45 tons per acre and appears to be lodging resistant.

Introduction of New Varieties

The Bureau's policy of taking precautions to prevent the entry of cane diseases into this comparatively clean area has been maintained in the planting of new varieties in an isolation plot, located some miles from the nearest commercially produced cane. In August, 1955, five Badila types, 2 "I" series, 8 "L" series, 2 "K" series seedlings, and the variety Azul were received from the Northern Experiment Station and planted in the isolation plot. Regular inspections throughout the year have located no disease symptoms, and plants will be included in 40 sett plot plantings on the Station.

Effects of BHC on Crop Production

Although no detrimental effects on crop growth were noted in the plant and first ratoons of the trial using different amounts of BHC in its crude form and as refined gamma isomer, the field was replanted in 1955, and retreatments with BHC followed the original plan. The plant crop to be harvested in 1956 shows no apparent yield differences, but further retreatments will be carried out over a number of years to determine whether any cumulative toxic effect can be detected.

Ratooning Experiments

Efforts to ascertain why ratooning is not more extensively practised in the Burdekin, led to the establishment of a long range ratooning trial on this Station. Adverse growing conditions and some soil variability in the field resulted in uneven yields in the plant crop harvested in 1955. This trial has now been abandoned and plans are being prepared to establish a trial in a more suitable form on uniform soil.

In order to study the decreasing yields frequently obtained after several years of ratooning, a small area was planted in June, 1956, and this will be ratooned for as many years as crops can be produced. It is hoped that some correlation betwen the age of each crop and its yield may be obtained.

Effect of Hot Water Treatment on Disease Control

Treatment of plants infected with ratoon stunting disease, for different times, and at different temperatures, was carried out in 1955 to ascertain the time/temperature effect on plant germination and on the subsequent control of the disease. It was noted that treatments at 50° C. gave improved germination over the controls, but treatments at 51° C. and 52° C. adversely affected the strike. Thick and thin plants of each of the four varieties were treated at each time/temperature combination to ascertain whether thicker stalks might require a longer period of immersion to cure the disease.

A trial on similar lines planted in 1954 gave limited information, for satisfactory disease symptoms could not be located in the untreated cane because of internal stalk rots developing and masking symptoms which, under normal conditions, are often difficult to detect in the Burdekin area.

A trial aimed at improving the germination of hot water treated plants by soaking them in oxidising solutions of sodium peroxide and potassium permanganate, these being used separately, and in combination with a mercurial solution, was established. Results, however, indicated that treating in a weak mercurial solution, the standard method, gave more satisfactory results.

Germination Stimulation Trial

Since pre-planting treatment of setts was first introduced, the more rapid germination of plants so treated was apparent. A trial to compare the stimulation of new mercury-based fungicides with those in common use, indicated that the ones in common use were superior to many new compounds.

Legumes

About 60 legumes were planted on the Experiment Station to check on their suitability as green manure crops. Some of the *Dolichos*, *Phaseolus* and *Cyamopsis* species are worth

further trial. In contrast, most *Sesbania* species produced woody stems, light foliage, and poor cover.

Field Day

Because of the prolonged wet weather the Station's annual field day, which was arranged for mid June, 1956, was postponed and will now be held at the end of July, 1956.

Laboratory Work

The following is a summary of cane analyses handled during the year.

Station samples	557
Farm trial samples	299
Cyclone damage investigation	430
Farmers' samples	23
Total	1309

Summary of Crops Grown on the Station

Varieties harvested in 1955 milling :

	Tons
Trojan	53.70
Badila	35.70
S.J.16	42.55
Experimental varieties	755.81
Total	887.76
Plant cane harvested	430.04
First ratoon cane harvested	457.72
	887.76
Total cane harvested for milling	887.76
Used for samples, plants, etc. (estimated)	36
Total Crop	923.76
Total acreage harvested	28.38 acres
Average tonnage per acre	32.55 tons

Central Sugar Experiment Station

C. G. Story, Officer-in-Charge

Notes on Weather and Crops in the District

Following the heavy and prolonged wet season of early 1955, which culminated in phenomenal rainfall at the end of May, dry conditions were experienced until October, when general rainfall was experienced in the Mackay district. This relief rain, with falls of one and a half inches, was appreciated as drought conditions were approaching in some parts.

This rainfall, plus some two inches at the beginning of November, upset the otherwise excellent harvesting weather conditions which had prevailed, and interrupted crushing for a short period of 30 hours. December was a hot, practically dry month, and soaring temperatures marked the close of the Christmas-New Year period with a record temperature of 105 degrees on the 31st December, and 102 degrees on the 1st January; the average maximum temperature for December, 1955, was six degrees above that of December, 1954. The year closed with general rains being required for all crops except those in the Finch Hatton area which received good rain early in December. The rainfall for the 1955 year at the Sugar Experiment Station was 11,408 points recorded on 140 days; from the 1st July to 31st December, 685 points were recorded on 35 days.

Conditions for the second six-monthly period under review, January to June, 1956, included good rainfall, exceptionally so in March, with lighter rainfall from May to June preventing any effective farm operations, maintaining all heavy low areas in a wet condition and delaying commencement of the 1956 crushing season to the end of June. Total rainfall for the six months was 7,542 points recorded in 89 days.

The district experienced an open winter in 1955; some cold days were experienced, but often the temperature during the winter months approached near summer level. Three nights of frost were recorded during July and August.

The aftermath of the heavy unseasonal rain in May, 1955, was reflected in late planting programmes in parts of the area, especially on the heavier soil types. Labour shortages and wet soil conditions upset the planting programme. Although the greater proportion of planting was completed by the end of August, some extended into September and October. This is too late for Mackay, as experience has shown that it is better to ratoon blocks of established cane than to plant fresh areas in October.

The moist soil conditions following the May, 1955, rainfall were beneficial to standing cane for many months. At the end of September standing cane was in good condition, sugar content was favourable, harvested crops were generally ratooning well, young plant cane was not showing the effects of the dry conditions, and germinations were generally good.

The crop position had changed by the end of October when red rot was affecting Q.50, with some death of cane; this became worse in November when the variety had deteriorated on a number of district blocks; however, by the end of the year, despite red rot and low sugar, Q.50 was giving reasonable results for a harvest which had progressed well beyond the period for harvesting Q.50. This emphasises that the percentage of the variety grown in Mackay is too high for the district.

The crop status changed considerably during the second half of January, 1955, with the onset of monsoonal rains which brought relief after a month of hot, dry weather, and terminated the extended harvesting operations. Strong sunshine and very hot, humid conditions, with intermittent rainfall at night, which allowed the excess water to drain away, ensured the com-

Fig. 32—The uncompleted office-laboratory building at Mackay Station.

plete recovery of crops from the setback in December, and provided ideal conditions for cane crops in February.

March will be remembered for some record local rainfalls and floodings, and the cyclonic winds on the 5th and 6th. Proserpine had its heaviest flooding in 31 years and Calen its worst for 50 years. The Pioneer River rose higher than the 1918 flood level following 17½ inches of rain in five and a half hours at both Owens Creek and Finch Hatton. This torrent of water destroyed the high level concrete and steel railway bridge at Mirani. Rainfall for the month occurred in two periods; the value of the first was partially lost due to the cyclone, the second assisted varieties to overcome root damage sustained from cyclonic winds, and the cane made excellent progress. The district was fortunate to miss the full force of the cyclone—which, however, left its attendant harvesting problems. A feature of this cyclone was the absence of rain prior to and at the height of the blow.

Abstract of Meteorological Observations made at the Central Sugar Experiment Station from 1st July, 1955, to 30th June, 1956.

Month	Rainfall (Inches)	No. of Wet Days	Shade Temperature						Mean Diurnal Range	Mean Temperature 9 a.m.	Mean Per Cent. Relative Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1955											
July	·37	5	83	66·5	72·9	65·5	40·5	51·9	21·0	64·79	75·06
August	·16	2	89	66·5	77·7	59·5	36·5	50·6	27·1	68·29	68·10
September ..	·43	9	89·5	73	79·0	64	50	58·3	20·7	72·60	68·90
October	2·06	6	103	77	86·7	71	50·5	63·3	23·4	80·13	60·58
November ..	1·96	7	91	73	84·7	74	60	65·2	19·5	79·97	62·63
December ..	1·87	6	105	83	90·6	77·5	60·5	68·6	22·0	84·53	54·89
1956											
January ..	15·71	19	102	79	86·5	77	68	71·9	14·6	81·92	76·06
February ..	18·95	21	97	75	87·1	76	67	72·5	14·6	81·29	80·71
March	24·35	22	90	74	83·7	75	66	71·5	12·2	79·82	82·21
April	5·36	9	87	73·5	81·9	71	50	64·5	17·4	75·52	79·40
May	5·25	10	87	68	77·4	70	46	59·2	18·2	69·40	79·26
June	5·80	8	81	66	73·6	66	40	52·1	21·5	63·66	75·98
Totals ..	82·27	124									

Annual Rainfall since 1935 at the Sugar Experiment Station, Mackay

Year	Rainfall in inches	Year	Rainfall in inches
1935-36	99.57	1946-47	48.09
1936-37	64.21	1947-48	38.40
1937-38	47.21	1948-49	46.95
1938-39	61.29	1949-50	85.48
1939-40	82.86	1950-51	107.63
1940-41	73.71	1951-52	41.68
1941-42	57.75	1952-53	56.58
1942-43	76.13	1953-54	102.57
1943-44	58.67	1954-55	129.44
1944-45	33.53	1955-56	82.27
1945-46	68.52		

Average for 21 years: 69.64 inches.

Practically no early planting occurred for the third year in succession. Light showers occurred the first and last weeks of April, with heavy rain in some areas on the last day of the month, while most of the rain in May occurred in the first half of the month. Proserpine had the dubious distinction of being the second wettest area in Queensland at the 1st May.

A heavy growth of winter weed (*Ageratum conyzoides*) developed in most cane blocks in the district. Some varieties arrowed in May, with further arrowing in June, when the district cane crop was in very good condition. Rainfall during June delayed the commencement of crushing and planting programmes.

Legume Crops

Excellent crops of legumes were grown during 1956. The cyclone burnt young green leaves of velvet bean plants in March, but these recovered without apparent loss to the crop. Canegrowers have become increasingly interested in the value of leguminous crops, but, unfortunately, during 1955 the heavy demand for velvet bean seed far exceeded the supplies available from seed merchants in the district. Considerable areas of Reeves' Selection cowpea were planted. A useful farm practice would be the storage of a year's supply of seed every year, thus ensuring seed being available when required. Culture for treating legume seed was in good demand.

Organic Mercurials

Mercurials for stimulation of germination, and for pineapple disease control, were used extensively, but the demand for material exceeded the supply available at one period in July. Unfortunately, some canegrowers expect far more from a mercurial than the fulfilment of its normal purpose; it is not a cure-all for poor farming practices. Pineapple disease was responsible for losses in germination in odd blocks in September at Farleigh, Owens Creek, and Alexandra.

Fertilizer

Growers have become more interested in the economics of fertilizing, but there was a bottleneck and lag in supply during the period of heavy demand in October-November, 1955. This bottleneck suggests that long range planning and organising by both the agents and the growers would do much to alleviate the position to the mutual benefit of both; fortunately, this is to be the procedure for 1956.

A shortage again occurred in January when 750 tons of sulphate of ammonia were held up on a ship in the harbour, due to a waterfront dispute.

Minor Element Deficiency

Cane at Mt. Charlton and Shoal Point showed evidence of copper deficiency symptoms, and the recommended treatment of copper sulphate at the rate of 55 lb. per acre was applied.

Weedicides

Canegrowers showed added interest in the use of the weedicide TCA in the control of guinea grass and para grass. Labour shortages and late plantings fostered a keener interest in the control of nut grass by weedicides. This proved time-saving compared with ordinary cultivation methods, as one spraying gave satisfactory control for six weeks, whereas a number of cultivations was required to obtain the same effect.

Pests

Damage to the 1955 crop from either greyback or frenchi grubs was extremely light. Very light, odd flights of greyback and frenchi beetles occurred during 1955-56. Wallabies damaged cane on outlying farms in September, and towards the end of the year. The Mackay

Fig. 33—Advanced cane seedlings in pots at Mackay, July 1956.

Cane Pest and Disease Control Board established a beagle stud to provide dogs to combat this pest. White cockatoos were responsible for damage at Flaggy Rock in July and at Proserpine in November, 1955.

Wireworms affected small areas where canegrowers did not give protection to plants by the use of BHC in planting mixtures. Unfortunately, some growers persist in applying BHC at lower than the recommended rates. Loose swarms of the spur-throated locust *Austracis guttulosa* (Walk.) appeared in the district in October, 1955, and small populations have continued to appear until June, 1956. One small infestation of army worms occurred at North Eton. Rats were more numerous than normal for the last 14 years; the monetary losses sustained in cane were due to the extra cost incurred in harvesting the damaged cane.

A study of an infestation of *Margarodes* at Mt. Convenient gave some information on the life history of this particular species.

Diseases

The total number of farms infected with chlorotic streak disease in the central district increased to 321. The disease is now known to occur on every major watercourse; although older ratoon blocks have not yet been inspected, it is anticipated that disease will be found.

Yellow spot was present in greater proportion under the suitable weather conditions existing in 1956. Pokkah boeng was in evidence in various parts of the area early, but had outgrown its effects by the crushing period; eye spot was present in several fields of Trojan.

More attention is being paid to roguing mosaic in the central district. Rind disease was fairly widespread towards the close of the season. Witches' broom was fairly common in Q.50.

An interesting discovery was pokkah boeng in elephant grass; and a spot resembling brown stripe of sugarcane was found in guinea grass at Inneston.

Poor Ratooning

Large patches in blocks of the variety Q.50 which had been harvested in August-September failed to ratoon by the end of October in parts

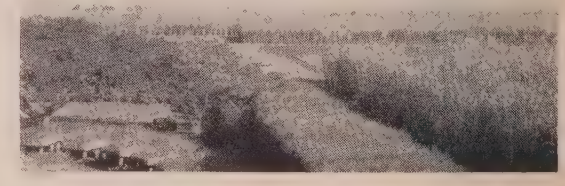


Fig. 34—Looking over the Experiment Station fields. In the right foreground is a field of one year old original seedlings, while the next year's seedlings are in pots on the tables in the left foreground.

of the area; both the earlier and later harvested Q.50 was not affected. These failures generally followed a good crop of plant cane, often on new land. Red rot in association with verticillium was suspected as the cause, but no definite conclusions were drawn In other instances red rot was responsible for poor

ratoons. The varieties N.Co.310, Q.58, and C.P.29/116 gave excellent ratoons under similar conditions.

Clean Cane Plant Propagation

Nucleus plantings of approved varieties were made by the Cane Pest and Disease Control Boards with cane varieties treated at 50° C.

Fig. 35—A plant crop of Q.63—one of the promising new varieties.

for three hours. Generally, good germinations were obtained with this treatment. Other cane was treated for chlorotic streak at 52° C. for 20 minutes. Following the continuation of the programme of hot water treatment of cane for ratoon stunting disease the results achieved are very promising for the eventual control of this disease in the district.

Cane Loaders

The extended wet season during 1955, together with a proportion of wind-damaged cane, brought harvesting problems to canegrowers in the 1955 season. A solution was found in the use of front end loaders, 163 of which were in operation by the end of the year. The demand for machines far exceeded the supply. Their use also brought crushing problems to the mills with stones, soil, and trash being delivered to the carrier with the cane. Some mechanical harvesters were also in operation and two new harvesting machines were developed in the district.

Drainage Schemes

Drainage is very important to successful canegrowing in the Mackay district and three community drainage schemes inaugurated were of benefit to the growers concerned in the Te Kowai-Peri-Wallingford areas. Bulldozers have also been used to increase drainage through swampy areas and the soil has been added to the low areas to raise and improve the land for canegrowing.

Modern Building

A new, tiled roof brick building containing a modern laboratory and offices is being erected at the Experiment Station to replace the old building which has served the needs of the district for the last 55 years. Work commenced on the site on the 1st September, 1955.

EXPERIMENT STATION OPERATIONS

Seedling Raising

A total of 7,917 seedlings, representing 76 crosses, were planted in the field during 1955.

Annual Seedling Selection

Selection of two batches of seedlings planted in the field in August and October, 1954, resulted in 138 seedlings, representing 33 families, being carried forward for vegetative reproduction and comparison with standards. The August planted seedlings were poor, while the general vigour of the October planted seedlings was satisfactory, considering age, growth conditions, and late progress. At the same time

Fig. 36—Plant Q.58, which is attracting some attention in the Mackay area.

five varieties, H.25, I.70, Q.61, Q.62, and Vesta, were included in the planting.

Progressive Seedling Trials

Thirty-seven of the "1952" series seedlings were selected from the first ratoon 30-sett plots. These seedlings, plus two Barbados canes, B.40/98 and B.41/211, were planted in a yield observation trial with Q.50 as the standard.

The yield observation trial of 21 "M" series seedlings and eight "L" series seedlings planted in 1954 was harvested in October, 1955. At harvest, Q.50 was superior to all except one seedling. Selections of any which justify inclusion in replicated trials will be made on the first ratoon crop.

The "M" and "K.P." series seedlings (Badila crosses) were good for their type on this poorer soil; the full value of these will be ascertained when planted in a replicated trial on better class land in 1956.

The first ratoon crop of the yield observation trial of 24 "L" series seedlings was harvested in October, 1955. It included three introductions —F.108, P.O.J.3016, and 38S.N.473. "L" series seedlings 219, 224, 231, 233, 247, and 266 were selected for further planting in a replicated trial.

Other progressive trials with seedlings were harvested from canegrowers' properties. Another seedling, I.126, raised at the Station, was allotted the "Q" number 65.

Variety Introductions

Eight cane varieties released from the Brisbane quarantine house during 1955 were planted on the Experiment Station. These included Co.285, Co.312, Co.313, and Co.513 from India; C.P.51/27 from Canal Point; Ebene 1/37 from Mauritius; and P.R. 1000 from Puerto Rico.

Rotary Filter Mud Has Low Fertilizer Value

Rotary filter mud has been used as a fertilizer in the district for many years. A second trial to obtain information on its value as a fertilizer was planted in August, 1952, the treatments comprising 20 and 40 tons per acre and a control. There is also incorporated a fertilizer trial in which the value of 0, 1½, and 3 cwt. per acre of Sugar Bureau No. 2 Mixture is being investigated in conjunction with the varying amounts of mud.

The second ratoon crop was harvested in August, 1955. The response to fertilizer was well marked, but there were no significant increases in yield due to the mud applications. The trial, however, showed that a 40 ton application of mud was less beneficial than 3 cwt. of fertilizer.

Sweet Sorghum and Legumes as Soil Amendments

The second ratoon crop of the soil improvement trial containing the treatments velvet bean, sorghum, and a velvet bean/sorghum mixture once again showed that sweet sorghum was doubtful as a soil improver under field conditions. The velvet bean and the velvet bean plus sorghum treatments gave a slightly higher yield of cane per acre than the check plots or the sorghum alone. These differences were significant at the five per cent. level. There were no differences in sugar per acre.

Short and Long Fallowing Trials

The four pre-planting treatments applied to this block were (a) a six-months legume fallow, (b) a four-years grass fallow, (c) a two-years grass plus six-months legume fallow, and (d) two and a half years perennial legume fallow. The fallow periods were arranged so that all plots were ready for planting with cane at the same time—August, 1952.

Over the plant and two ratoon crops the harvested tonnages were as follows:—

	Treatment			
	(a)	(b)	(c)	(d)
Plant	30	45	39	40
1st Ratoon	25	30	25	25
2nd Ratoon	24	27	23	23

It is apparent that the long grass fallow treatment (b) resulted in increased cane tonnages in all crops, but it is equally apparent

that the effect of (c) and (d) treatments did not extend beyond the plant crop. It is somewhat surprising that treatment (c) was no better than (a) in the ratoons, since the former included a two-years grass fallow. The treatments are not replicated and it is accordingly impracticable to assess the significance or otherwise of the results.

Fig. 37—The legume C.P.1.9247 on Mackay Station. This was planted in November, 1955, and photographed in July, 1956; the cover is still good.

Nitrogen Trial

A trial was planted in August, 1954, to determine (1) the effect of increasing amounts of sulphate of ammonia on sugar and cane yield; (2) the suitability of urea as a topdressing compared with sulphate of ammonia. The results of this trial (see Fig. 15) provided further justification for the assumption that spectacular responses are not obtained by applying heavy dressings of sulphate of ammonia to plant cane in Queensland.

There was also little doubt that the application of sulphate of ammonia depressed the sugar content of the cane throughout the harvesting season, July-December, but it was not possible to detect any consistent relationship between c.c.s. and increasing nitrogen. The responses due to urea and sulphate of ammonia were similar in all respects.

Time/Temperature Treatment Trial

A trial based on six varieties and ten time/temperature treatments was planted at the end of September, 1955. An additional modification to the previous trial planted in 1954 was that the setts of each variety were divided into thick and thin types for each treatment to determine the effect of thickness on heat treatment. To avoid overlapping of the two classes, setts were selected so that there was a difference of at least one quarter of an inch between the thickest of the "thin" group and the thinnest of the "thick" group. There was a tendency for thick setts to give a better germination than the thin ones and the vigour of the young cane appeared better in plots from thick setts.

The first ratoon crop from the trial planted in 1954 showed a better growth of cane in the treated rows compared with the untreated diseased rows of cane. The general conclusion from this trial was that the chances of complete control of the disease are improved with an increase in either time or temperature; an increase in time at the minimum effective temperature is preferable to an increase in temperature.

Fig. 38—At Mackay Experiment Station Field Day. The display of front-end loaders attracts the interest of visiting growers.

Chemical Treatments to Improve Germination of Hot Water Treated Plants

An experiment was planted to determine whether weak solutions of the oxidising agents sodium peroxide and potassium permanganate would have a stimulating effect on the germination of cane which had been hot water

treated for three hours at 50° C. The results showed that the oxidising agents were inferior to the standard mercurial treatment.

Experiment with Bagasse and Deep Ripping

Slight differences in favour of bagasse and/or deep ripping compared with normal cane-growing procedure were obtained on this first ratoon trial, but these differences were not so outstanding as in the plant crop. The heavy, prolonged wet season would tend to neutralise the effects of the treatments. It is considered that low annual rainfall and drought conditions for a long period would allow a better appreciation of the treatments in this type of trial. The results from a deep ripping trial in the Eton area were unsatisfactory due to prolonged wet conditions.

Long Term Trash Trial

The trash experiment was begun in 1949 and, to date, five crops have been harvested, being the plant, first and second ratoon of the first rotation, and the plant and first ratoon of the second rotation. There is some improvement apparent in the "trash" sections but it is yet too early to state that this is more due to the treatment than to soil variability within the trial area. The value of the trash can be assessed only over a long period which will cover a range of seasons.

Trial with New Legumes

Two legume trials were planted in 1955. One, planted on the 10th November, 1955, consisted of 13 legume varieties including cowpeas, Mung Bean, and Nardello Mung Bean, which were planted in a comparative trial with Reeves' Selection cowpea and velvet bean. The outstanding cowpea variety was C.P.I.9247 which possessed the qualities of a good, early cover crop and this continued for a period of eight months. This legume has given consistently good results in trials and would be a suitable variety for the Mackay district. The second was an exploratory trial with seed of 51 various legumes obtained from the C.S.I.R.O. Many of these were discarded but seed was collected for further plantings in 1956 of 17 *Phasoelus* spp. and three *Dolichos* spp.

Weedicide Investigations

Sodium trichloroacetate was used singly and in combination with 2,4-D at varying strengths on grasses and weeds. Some breakdown in control occurred where torrential rainfall followed the application. At the rate of 100 lbs. per acre excellent results were obtained on couch grass (*Cynodon dactylon*) A similar rate of application around buildings, along fence lines and in drains confirmed the good results obtained previously with grasses.

Following control of a mixture of grasses along a headland in another experiment, winter weed (*Ageratum conyzoides*) and *Bacop procumbens* appeared on the bare ground. A separate spraying with 2,4-D was necessary to control these; it appears that single sprayings each of TCA and 2,4-D or a combination of TCA and 2,4-D are necessary for complete results.

The weedicide 2,4-D gave longer control of nut grass than the weedicide combination spray MCPA/TCA. A combination spray composed of 1 lb. per gallon PCP and 9 lb. per gallon creosote, plus an emulsifier, gave quick and useful results against *Ageratum conyzoides*

Large bare areas remained at the end of June in blocks of cane sprayed with 2,4-D for bell-vine control in April. In addition to killing the bell-vine it had an effect on nut grass and other weeds.

Annual Field Day

On the 12th June, 1956, approximately 650 visitors called at the Station and were conducted on tours of inspection of the blocks. Among the many features on the Station, a display of leading seedlings and new "Q" varieties created considerable interest. Symptoms of dwarf, mosaic, chlorotic streak disease, and copper deficiency were exhibited. The tractor and implement display was excellent.

Laboratory Work

The following is a summary of the c.c.s. analyses carried out during the year:—

Experiment Station	999
Farm Trials	802
Growers' Samples	94
Show Canes	51
	1946

Summary of Crops Grown on Station

Varieties harvested during 1955 Season:—

	Tons
Q.50	417.2625
Seedlings	333.375
Total	750.6375

Plant Cane harvested	219.575
First Ratoon Cane harvested	244.9125
Second Ratoon Cane harvested	286.15
Total	750.6375

Total Cane harvested for Mill	750.6375
Used for samples and plants	21.7125
	772.35

Total acreage harvested	34.5 acres
Average tonnage per acre	22.39 tons

Southern Sugar Experiment Station

H. G. Knust, Officer-in-Charge

Notes on Weather and Crops

Normal weather conditions were experienced during the winter of 1955. Frosts were recorded in July and August, but did not cause any serious damage, and crop recovery was fairly rapid.

Dry conditions during the early spring months caused slight concern. Crops quickly recovered following relief rains, which fell toward the end of September, and but for a brief spell of dry weather during November-December, growing conditions were good for the balance of this crop year, and yields per acre should exceed those of 1955.

Unusual weather occurrences consisted of an intense hailstorm, which cut a swathe through the Woongarra area in September, causing severe shredding of cane leaves, with no apparent loss of crop. Freak windstorms which occurred in the Alloway area in February, and Pine Creek-Electra area in April, caused minor damage which will not affect the overall district production.

For the second successive year the average annual rainfall has been exceeded before the end of May. Minor flooding occurred in the Burnett and Kolan Rivers as a consequence of higher than average rainfall — fortunately, without damage to crops. Planting during the autumn months of 1956 has been seriously curtailed by excessively wet conditions, and good stands of early planted cane are not numerous. Much out of season—late autumn and early winter—planting has been practised by growers. This could easily result in poor germination and consequent considerable re-planting. Unseasonal heavy rain, accompanied by moderate south-easterly winds, occurred towards the end of June, 1956, and as a consequence, slight leaning with localised lodging was apparent in the well-grown crops. This could ultimately be responsible for reduced loadings to the factories. Winter conditions to the end of June have been mild.

Crop Harvest 1955 Season

The first of the southern mills began crushing operations on 29th June, and with the exception of Rocky Point, all were functioning by 27th July. No serious delays were caused by wet weather, and most mills would have finished crushing before the third week of December but for industrial trouble. Only one mill crushed into 1956, and when it shut down in mid-January, a considerable tonnage of cane was carried-over for the 1956 harvest. The tonnage of cane crushed by the mills in the Bundaberg-Isis district aggregated 1,440,862, with an outturn of 178,731 tons of sugar. The set-back which the crop received from the dry summer conditions in 1955 is reflected in the average yield of 24.1 tons per acre from 59,773 acres.

The Growing Season for 1956

The extended planting season in the autumn of 1955 and below normal stands of cane at the commencement of spring were not at all conducive to high yields for the 1956 harvest. However, as stated earlier, good growing conditions have prevailed generally since the end of September, 1955, and normal yields should be harvested from these plantings. Spring planted crops germinated well, grew rapidly, and should also produce satisfactory yields.

Ratoon shoots which came away reasonably well early in the season showed variable vigour, but recovered when temperatures increased and, in common with those which came away rapidly and vigorously later in the season, have produced a good stand of well-grown cane.

Reduced sunshine during the first three months of 1956 apparently has been responsible for arrow development. Flagging was first noted towards the end of April and, by the end of May, C.P.29/116 and N.Co.310 were arrowing profusely, while moderate to heavy flagging was showing in Q.47 and Q.49, with light flagging in Q.50 and Vesta.

Damage by Cane Pests

A heavy emergence of the cane beetles *L. trichosterna* Lea and *P. furfuracea* Burm. occurred in mid-December, 1955, in all areas normally affected by grubs. A light emergence of these beetles also occurred during early January, 1956. Grub damage was more widespread than in previous years, and fumigation with carbon bisulphide was successfully practised wherever it was considered economical to use it. Trials with BHC are continuing, and no firm recommendation can be made for the use of this insecticide.

Minor damage to cane was caused by larvae of the beetles *Rhopaea mussoni* Blkb. in the Coonarr Creek area. These were controlled by the usual application of carbon bisulphide. It was subsequently observed that survivors outside the fumigated area were highly parasitised by a Scoliid wasp.

A minor outbreak of grasshoppers *Austracris guttulosa* (Walk.) occurred in the Woongarra and South Kalkie areas during January. Light defoliation of cane occurred on the edges of some fields, but it was not necessary to practise control measures.

Damage by the nematode *M. javanica* (Treub) Chitwood, was observed in a field of cane at Mullet Creek. It was noted that growth of C.P.29/116 was retarded by this pest, while Co.290 seemed to resist attack. A trial to determine the resistance of approved varieties and advanced seedling canes is being established in this locality.

Exploratory trials with BHC dust against *R. dimidata* did not produce any conclusive results because the patchy, erratic occurrence of this pest makes it difficult to carry out satisfactory experiments. Further exploratory trials against this pest have been established with aldrin and dieldrin.

Ratoon Stunting Disease Control

Cane Pest and Disease Control Boards have continued the hot water treatment campaign for the control of ratoon stunting disease. Stocks of planting material available from hot water treatment since the campaign was first inaugurated in 1953 should be ample to meet the demand. All Boards will continue hot water treatment each year, for the purpose of maintaining new stocks for propagation and distribution to growers.

Outbreak of Downy Mildew Disease

After six years of freedom from downy mildew disease, a mysterious outbreak of this disease occurred on a South Kalkie farm. During the early period in which this disease caused considerable crop losses in the Bundaberg area, no infection was found on this, or adjacent farms. Cane Pest and Disease Control Board and Bureau officers took immediate action to suppress this outbreak, and further action will be taken to prevent the disease spreading.

Ratoon Failure

Investigations into the reason for poor ratooning have been given a major place in our field programme. An increase in the number of affected areas has been noted. Numerous trials with soil sterilants, insecticides, and fungicides, in addition to such mill by-products as bagasse, molasses, and filter muds, have been set out with the object of determining whether soil frequenting insects or a type of *verticillium* fungus found in association with the cane stubble is the cause of the ratooning failure.

Chlorotic Streak Disease

Chlorotic streak disease was recorded for the first time in the Bundaberg and Childers districts. In both districts, the outbreak occurred in poorly drained locations. All known infected stools were destroyed, and some of the areas in which the disease occurred have been ploughed out. In the Bundaberg area the finding was limited to a single diseased stool.

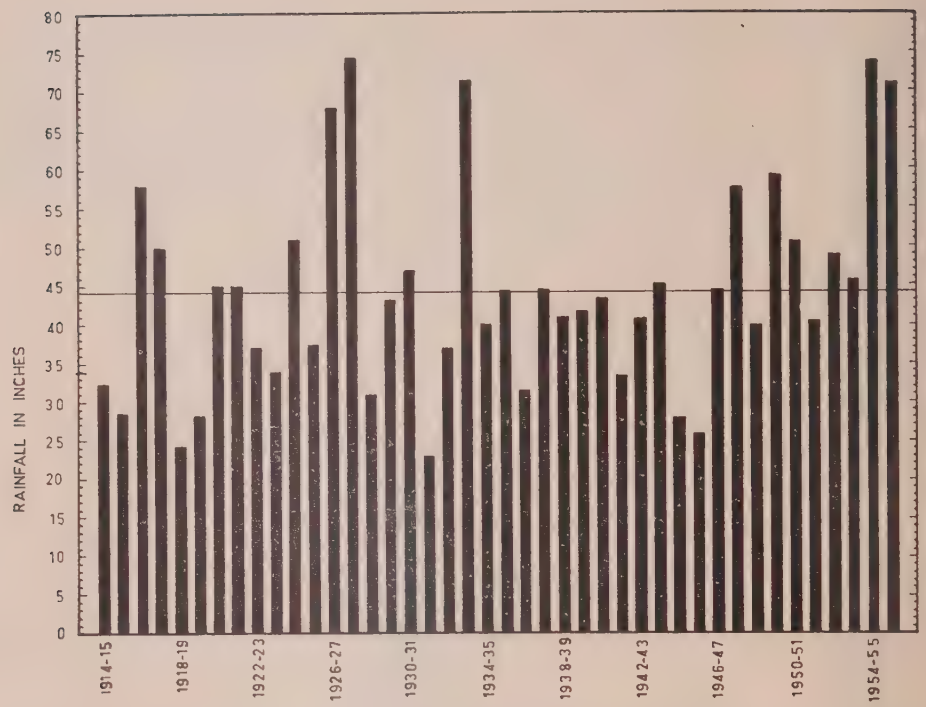


Fig. 39—Illustrating the run of high-rainfall years in Bundaberg in recent times. The horizontal line indicates annual average rainfall, and it can be seen that since 1946-47 there have been only two years of sub-average precipitation.

Abstract of Meteorological Observations made at the Southern Sugar Experiment Station, Bundaberg, from 1st July, 1955, to 30th June, 1956.

Month	Rainfall (Inches)	No. of Wet Days	Shade Temperature						Mean Diurnal Range	Mean Temperature 9 a.m.	Mean Per Cent. Relative Humidity 9 a.m.
			Maximum			Minimum					
			High	Low	Mean	High	Low	Mean			
1955											
July	1·59	9	74	63	69·41	63	36	49·80	20·61	57·93	76·90
August	·25	3	78	65	73·56	60	34	46·86	26·70	57·40	71·03
September ..	2·27	11	81	70	75·76	66	49	57·73	18·03	64·70	73·00
October	3·73	6	89	74	80·73	73	55	64·67	16·06	72·50	69·46
November ..	·76	4	87	74	81·83	74	54	65·50	16·33	74·06	65·00
December ..	5·88	7	91	80	85·04	74	58	65·24	19·80	77·69	65·38
1956											
January	5·72	18	90	79	84·11	75	61	67·96	16·15	79·82	78·17
February ..	18·73	22	91	74	82·85	74	61	68·25	14·60	78·88	84·51
March	11·31	26	86	74	82·03	74	65	70·13	11·90	78·80	88·89
April	6·93	14	85	75	79·76	69	50	62·25	17·51	73·64	81·43
May	5·75	5	81	68	74·10	69	42	53·71	20·39	65·68	75·13
June	8·21	6	78	59	68·44	62	40	50·11	18·33	60·03	81·19
Totals ..	71·13	131									

Rainfall Records, 1914-1956

Year	Rainfall in inches	Year	Rainfall in inches	Year	Rainfall in inches	Year	Rainfall in inches
1914-15	31.99	1935-36	44.24	1925-26	37.62	1946-47	44.52
1915-16	28.54	1936-37	31.65	1926-27	68.18	1947-48	57.76
1916-17	58.08	1937-38	44.40	1927-28	74.69	1948-49	40.18
1917-18	49.85	1938-39	41.01	1928-29	31.16	1949-50	59.31
1918-19	24.24	1939-40	41.69	1929-30	43.16	1950-51	50.74
1919-20	28.20	1940-41	43.26	1930-31	47.19	1951-52	40.42
1920-21	45.16	1941-42	33.52	1931-32	22.88	1952-53	48.99
1921-22	44.97	1942-43	40.75	1932-33	36.81	1953-54	45.81
1922-23	37.14	1943-44	45.22	1933-34	71.45	1954-55	73.95
1923-24	34.16	1944-45	28.14	1934-35	40.01	1955-56	71.13
1924-25	50.96	1945-46	26.10				

Average for 42 years: 44.5.

EXPERIMENT STATION OPERATIONS

First Year Seedlings

Selections from the first year seedlings totalled 770. This number, which considerably exceeds selections in previous years, includes seedlings which normally would not be considered worthy of selection, but which have been included in 6-sett plots with a standard for the purpose of determining the effect of micro-environmental conditions on original seedlings. These will be subjected to further selection for testing with a comparative standard variety.

Yield Observation Trials

Harvest results obtained from the yield observation trial which included 36 "N" series seedlings, B.41-227, C.P.43/47, C.P.44/155, H.39-5803, and H.47-2910 indicated that some of the "N" series seedlings and the canes imported from other countries showed sufficient promise for inclusion in a replicated randomised trial.

A further stage in the progress of the "M" series seedlings was completed with the harvesting of the first ratoon crop in the spring of 1955. B.37-161, C.P.36/111, C.P.36/183, C.P.43-64, C.P.44/101, C.P.49/50, H.37-1933, and F.134 were also included in this trial with Q.47 as the standard. Selections for propagation and trial on district farms were made just before the ratoon crop was harvested. Three "M" series seedlings and C.P.44/101 have been planted in a propagation trial at South Kalkie.

New Varieties Introduced

Cane varieties released from the Bureau's Brisbane quarantine and planted on the Station were Co.285, Co.312, and P.R.1000. In addition, H.37-6819, H.36-1804, H.32-6774, 41 R 2070, 46 R 1902, and H.48-3432 were introduced from the Colonial Sugar Refining Company, and H.106, H.130, I.106, I.126, I.162, and Q.63 were introduced from other Queensland districts. These are being propagated, and will be planted in the progressive trials for assessment in comparison with advanced seedlings and commercial varieties. The following introduced varieties are also being propagated for subsequent inclusion in comparative trials: B.47-44, B.47-419, C P.38/34, 40 SN 746, Azul, C.P.50/11, C.P.51/27, CI.38-32, EI/37, and Sirius.

The Indian canes, B.O.10, B.O.11, B.O.28, and B.O.29, were destroyed because a disease unknown to Queensland was found in these canes growing in another district.

Beerwah Isolation Nursery

Twenty-two Q.53 series seedlings were selected from the first year plantings of these canes, and forwarded to the Beerwah isolation nursery for ultimate planting and trial in the Moreton district.

Long Range BHC Toxicity Trial

This harvest completed the first cycle of a trial established in the autumn of 1952 with BHC, refined (88 per cent. gamma isomer) and crude (13 per cent. gamma isomer); it was

planted to determine whether continued heavy applications of this insecticide would retard crop growth. Grubs do not occur on the Experimental Station, so any reduction in yield could be attributed to toxic effects from the insecticide. There is no evidence that the insecticide has affected yields to date, as no significant differences have been recorded in yields which averaged 38.6 tons per acre in the plant crop, 34.6 tons per acre in the first ratoon crop, and 29.5 tons per acre in the second ratoon crop.

Trash—Fertilizer—Legume Trial

The fifth cycle of this fertilizer and plant residue trial, which was inaugurated in March, 1938, advanced a stage further with the harvesting of the first ratoon crop in spring, 1955. The trial area is divided into six blocks, and on two of these the trash is turned into the soil and a green manure is grown during the fallow; on another two the trash and crop residue are burnt at harvesting, and a green manure crop is grown during the fallow, while on the remaining two blocks, the trash and crop residue are burnt at harvesting, and no green manure crop is grown before planting cane. A fertility trial which includes K, PK, NK, and NPK dressings is superimposed on the above cultural treatments, and their reaction is noted in relation to the basic treatments. In all treatments the response to N was significant, both in cane and sugar per acre. As was the case in the plant crop, the "trash burnt — no green manure" crops gave lower yields than the other two treatments. Furthermore, "trash and green manure" was better than "green manure" alone. This implies a beneficial response to trash, but the reason for this is not clear. The response to P recorded in the plant crop was not sustained; a response to this plant food is rarely recorded on this soil type.

Nitrogen Trial

Harvesting of the second ratoon crop completed this trial which was inaugurated in the autumn of 1952. After each harvest, Sugar Bureau No. 3 planting mixture—which is low in nitrogen—was applied to the ratoon stools. When the shoots were well established, sulphate of ammonia top dressing was applied in more than one application, and at different times, to assess the value of the treatments. Sulphate of ammonia at the rate of 300 lb. per acre was applied as follows:—

1. 300 lb. in December;
2. 150 lb. in November + 150 lb. in December;
3. 100 lb. in November + 100 lb. in December + 100 lb. in January;
4. 75 lb. in November + 75 lb. in December + 100 lb. in January + 75 lb. in Februray.

The two major varieties of the district, Q.50 and C.P.29/116, were grown in this trial. While the plant and first ratoon crops were harvested in September and produced somewhat similar results, the second ratoon crop was harvested in December, and it is interesting to note that C.P.29/116 outyielded Q.50 in tons of cane and sugar per acre at the five per cent. level. All applications of sulphate of ammonia gave higher yields than the plots which did not receive a top dressing of sulphate of ammonia, and treatments 1, 2, 3, and 4 significantly exceeded the no sulphate of ammonia treatment in tons of cane and sugar per acre at the one per cent. level. It seems there is nothing to be gained by splitting the applications of sulphate of ammonia, as no clear differences due to this method could be determined.

Assessment of Old Varieties

As sufficient ratoon stunting disease free stocks of the older varieties Co.281, Co.290, M.189, P.O.J.2725, and Q.813 had been built up for trial purposes, these were included in a trial with Q.47, Q.49, Q.50, and C.P.29/116 in the spring of 1955. In the absence of ratoon stunting disease, it should be possible to assess the value of the older varieties by comparison with the newer ones, when yield figures are obtained in the spring of 1956. Clean stocks of D.1135 and P.O.J.2714 are being built up for the same purpose.

Legumes

Extensive testing of legumes has been practised during the year for the purpose of finding varieties which may be suitable for southern

conditions. An observation trial contained 57 varieties of *Phaseolus, Dolichos, Cyamopsis, Sesbania,* and *Mucuna* species. These were made available to the Bureau by the C.S.I.R.O.

Fig. 40—Effect of heavy rain at the Bundaberg Station. Original seedlings at left are partially submerged.

Thirteen strains of velvet beans *Mucuna* sp., imported from South Africa, have been propagated for subsequent distribution and testing in all cane growing districts.

Weedicide Investigation

Although only minor break-downs have been experienced with the sodium salt of 2,4-D, which has been used on the Station for some years for premergence weed control, the newer compounds are tested to assess any improved weedicide value. Trials with Amizol 90, applied at three levels — 1 lb., 2 lb., and 4 lb. per acre—did not produce satisfactory results.

Annual Field Day

Some 500 cane growers, mill officers, and other persons associated with the sugar industry attended the field day in April, 1956. These occasions are of considerable value to the sugar community, as they afford the opportunity to inspect and discuss seedling raising, varietal testing, and other investigational work.

Laboratory Work

Following is a summary of cane and water samples handled during the year:—

Station and trial cane samples	1024
Farmers' cane samples	776
Irrigation waters	13
	1813

Summary of Crops Grown on Station

	Tons
Seedlings	363.2125
Q.50	266.6875
C.P.29/116	47.075
Q.47	15.0875
Q.49	5.8
P.O.J.2878	5.1
Vesta	5.1
Q.55	2.5
	710.5625
Plant cane harvested	223.075
Ratoon cane harvested	487.4875
	710.5625
Total cane harvested for mill ..	694.8625
Used for samples and plants ..	15.7
	710.5625
Total acreage harvested	20.9 acres
Average tonnage per acre ..	34.0 tons

Division of Cane Breeding

J. H. Buzacott, Senior Plant Breeder

Introduction

The year 1955-56 was one of great activity for the Division of Plant Breeding. The more extensive study of problems of inheritance and selection, which has been instituted during the past two years, implies a much stricter control on the possibility of contamination with stray pollen during cross-pollination. Naturally, the interpretation of results is rendered difficult

Fig. 41—A section of the new cross-pollination set-up at Meringa.

when contamination is a possibility. It was convincingly demonstrated during the 1955 cross-pollination season that contamination was not only a possibility but was actually occurring to a serious degree. This discovery necessitated a complete reorganisation of cross-pollination methods and materials. Investigations into the problems of selection also required a more complicated experimental procedure which needed a greater effort at a period when the Division's activities are always at peak—that is to say during the time of cross-pollination, seed packing and despatch. Projects of lesser magnitude included legume breeding, the investigation of substitutes for sulphur dioxide for keeping arrows in solution, experiments in photoperiodic and chemical control of arrowing, and experiments to try to determine the correlation of refractometer brix with sucrose with a view to using refractometer brix for testing seedling selections.

New Equipment

For the purpose of further seed storage experiments, and particularly for the better keeping of stored seed for Mackay and also for the storage of quantities of seed from varieties which arrow rather rarely, a low-temperature refrigerator has been procured. A new oven with controlled air circulation was installed largely for the pre-germination of cane seed to determine which crosses should be packed and which discarded. An electric soil sterilizer was ordered and despatched from England and its delivery is expected in the near future.

Reorganisation of Cross Pollination

The reorganisation of the cross-pollination set-up, which was forecast last year, included

Fig. 42—The frames shown in the previous photograph are now supporting the fabric lanterns. Note tying of skirts to exclude foreign pollen.

the construction of a new type of lantern framework and stands, together with the fabrication of 86 lanterns made of six different materials. The new frames each consist of

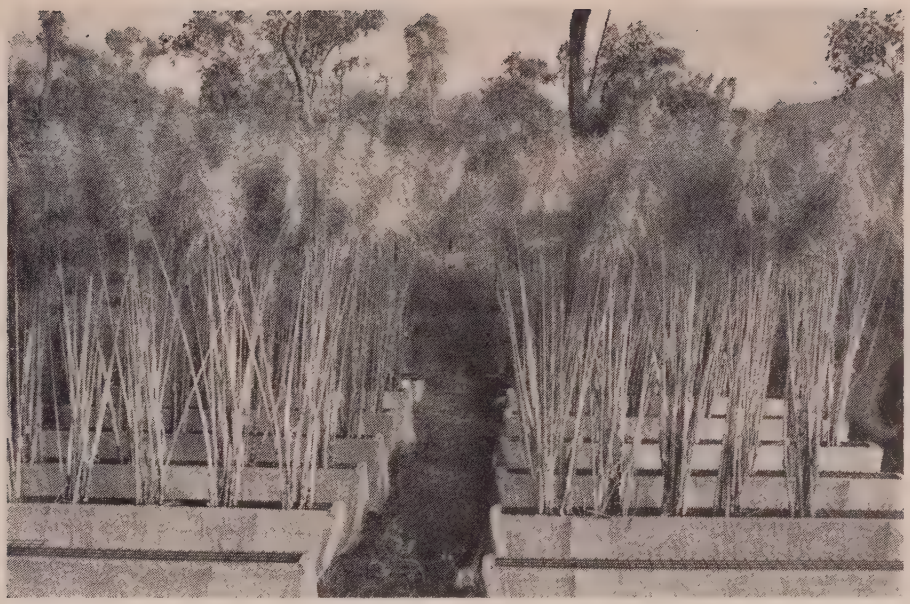


Fig. 43—The 1956 polycross.

two square frames of bar iron to which the lanterns are tied internally. Formerly, the lanterns were fitted externally on wooden frames and these frames were a continual cause of breakage of arrows during the setting up of crosses. In the new lanterns the cloth covers remain free of internal obstructions. Before purchasing materials for the new lantern covers a large number of samples of different fabrics was examined and only a few selected in which the pore spaces in the material were not large enough to allow sugar-cane pollen to pass through. Very few of the materials tested filled these specifications and were still sufficiently light in weight for the purpose required. Five cotton fabrics were finally chosen for further testing whilst a number of test lanterns were made from plastic material with one cloth side for ventilation. Crepe-de-chine, which was tested in 1955, proved unsuitable as its lasting qualities are very poor when exposed to the weather.

All new lanterns were fabricated with skirts which were tied round the cane stalks early in the morning before pollen was shed and untied after the shedding ceased for the day. The untying of the skirts was necessary because, when the lanterns were kept tied day and night, rather bad moulding of the arrows occurred due to insufficient ventilation.

In addition to the normal cross-pollination for seed production, a rigid testing programme was carried out on the new lantern materials. At the time of writing, test germinations have already shown that no seed has been produced by male-sterile arrows maintained in the new lanterns, whilst parallel tests of arrows maintained in the old-type voile lanterns produced numbers of seedlings which showed that pollination by stray pollen was occurring through the voile fabric. Similar tests in the new lanterns with tied and untied skirts showed also some contamination from stray pollen when the skirts were left untied.

All crosses for seed production in 1956 were made under the various types of new lanterns and it is planned to increase the number of lanterns for the 1957 season to 144. This is in contrast to the two batteries, each of ten lanterns, together with a large number of open crossing stands dispersed through the

forest, which constituted our cross-pollination equipment in the past.

In order to facilitate the handling of the polycross, which now features yearly in our programme, new arc-mesh stands were built to form a permanent polycross lay-out which

Fig. 44—The experimental testing of different solutions for keeping cane fresh during cross-pollination.

greatly facilitates the servicing of the polycross. Five hundred and fifty-three arrows of 35 select varieties listed in Table VIII (a) were used this year as females in this phase of seed production. The bi-parental crosses are shown in Table VIII.

Protection of Crossing Drums

Some difficulty is always experienced with the drums used to contain the sulphurous acid-phosphoric acid solution during cross-pollination. This is due to the fact that the sharp cut ends of the cane stalks scratch through the acid resistant bitumastic paint used to coat the drums internally. Contact of the solution with bare iron sets up a contamination which causes the arrows to die. An interesting discovery this year was that discs cut from the inner tubes of motor tyres and used to protect the bottoms of the drums had a deleterious effect on seed setting. When discs of plastic material were substituted for the rubber, seed setting was normal.

Alternative Solutions for Keeping Arrows

During the year very many substances were tested as substitutes for sulphur dioxide for keeping cut stalks of sugar cane alive. The materials tested included a number of proprietary brands of fungicides and bactericides and also chemicals such as sodium peroxide, maleic hydrazide, and the nutrients, alum-glucose and magnesium sulphate-sucrose. Of the eighteen solutions tested only Zephiran, Cetavlon, Flor-vita, Cuprox, and alum-glucose kept the cane in better condition than water alone, whilst all solutions were far inferior to the standard sulphurous acid-phosphoric acid solution in their growth-maintaining properties.

Photoperiodic Control of Flowering

A small room was converted to a dark room for photoperiodic control of flowering during the 1956 season. Pressure of other important work limited the size of the experiment conducted on photoperiodic induction of flowering, and the varieties used were rather poorly grown in drums. The technique developed by Chilton in Louisiana was used and in the case of one variety, C.P.29/116, arrows were produced in mid-April, some three weeks earlier

Fig. 45—Close-up of portion of the experiment shown in previous figure. From left to right, canes standing in solutions of Cuprox, sulphurous acid, and Thiotox. Note the superiority of the sulphurous acid.

than usual with this variety. Co.290 flowered two or three days earlier than in the field, whilst the two other varieties in the trial, Badila and Q.44, which are both noble, did not

Fig. 46—Wheeling canes into photoperiod room for induction of flowering.

flower. This failure to flower may have been due to the poor growth of the plants used rather than the technique. The C.P.29/116 flowers produced were used in cross pollination with *S. spontaneum* Krakatau.

Maleic Hydrazide

Maleic hydrazide has now been incorporated in the cross-pollination as a standard method for delaying arrowing. Further experiments with this chemical for the control of nut grass showed that the mutual antagonism known to exist between maleic hydrazide and 2,4-D in the control of other weeds also occurs with nut grass. In consequence a mixture of these two chemicals is ineffective for the control of this pest. If 2,4-D is to be used to destroy the surface growth of nut grass it must be applied some days after the maleic hydrazide application. It was also demonstrated that maleic hydrazide acts selectively in the control of crowsfoot grass (*Eleusine indica* Gaertn.) and a 0.5 per cent. solution effectively kills this grass whilst grasses such as Parramatta grass (*Sporobolus capensis* Kunth.) are relatively unaffected by this concentration.

Standover Flowering Trial

The standover flowering trial, which was planted in 1954, gave little result in 1956. Varieties which do not normally flower in the first year of growth did not flower when stood

Fig. 47—A field cross with Krakatau spontaneum, using a flower of C.P.29/116 induced by photoperiod control.

Fig. 48—Spraying P.O.J.2725 with maleic hydrazide to delay arrowing—March, 1956.

over. Some varieties in the trial, which normally do flower, arrowed somewhat earlier and more freely as standover canes. P.O.J. 2878 showed this effect to a marked degree and, in the standover block, the first arrow of P.O.J.2878 emerged on 1st May, about a fortnight before this variety flowered on other blocks on the station. As a means of producing arrows in shy-arrowing varieties the method appears to possess no promise.

Seedling Raising

Seed germination was generally good at all Stations and the total number of seedlings planted in the field was about 42,000. This figure includes 5,881 at Bundaberg, 6,556 at Mackay, 6,240 at the Burdekin, and 23,294 at Meringa. This latter figure includes approximately 15,400 bunch-planted seedlings.

Bunch Planting

Experimental work in the comparison between bunch-planting and space-planting was continued. Unfortunately the cyclone of March, 1956, caused a lot of destruction in plots and precluded the possibility of obtaining reliable results from the experiment. However, the first fact in the comparison of the two methods was established, namely, that first selections from bunch-planted seedlings are superior to unselected space-planted seedlings. This fact may seem self-evident, but it was necessary to establish it, for if the first selections from bunch-planting were no better than unselected space-planted seedlings it would obviously not be the slightest use carrying out bunch-planting.

Sub-stations

In addition to the four main seedling-raising stations at Cairns, Ayr, Mackay, and Bundaberg, sub-stations at Babinda, Innisfail and Nambour were maintained for the development of varieties for these districts. The first planting on the Innisfail sub-station was made in the latter half of 1955 and, in common with the Babinda station, some 1,500 varieties were planted there. At the Nambour sub-station 22 selections were introduced for testing purposes.

Rich Land Varieties

The selection of varieties suitable for growing on very rich land without lodging was continued. All the earlier varieties selected, with the exception of I.233, were eliminated due to lodging when planted on very rich soils. I.233, although showing some weakness in ratooning, and a rather high susceptibility to leaf scald and chlorotic streak diseases, has still maintained its erect habit of growth even on the richest patches of land. Some excellent stands of this variety have been seen this year and a heavy demand for trial plots is being made. One other variety, L.469, selected at the Burdekin Station from the cross Trojan x Q.27 also shows some promise for

those soil types where lush growth is inevitable, and it is being propagated for further trials in all northern areas.

Fig. 49—First selection seedlings being planted in 2-sett plots on Meringa Station.

Chromosome Counts

Chromosome counts on certain varieties of cane were continued as opportunity offered. Following a report of the Senior Pathologist on the use of leaf-tissue smears for chromosome counting of sugar beet plants this technique was tried with sugar cane and found highly successful. It is noted that Dr. Price of the United States Department of Agriculture has also adopted the leaf tissue method. This technique used in Queensland consists of pre-treatment in α-bromo-naphthalene, followed by fixation in 1 : 3 acetic acid-alcohol, then staining with leuco-basic fuchsin followed by squashing in aceto-orcein. Using this method, chromosomes stain well and are more easily counted than they are in root tip smears. Counts made were mainly on varieties collected by the 1951 New Guinea Expedition, but a few check counts were made on noble or near-noble varieties used in breeding. The following figures were established:—

Variety	Species	2n
51 N.G.2	*S. spontaneum*	80
51 N.G.24	*Miscanthus floridulus*	38
51 N.G.25	*S. spontaneum*	80
51 N.G.26	*S. spontaneum*	80-82
51 N.G.88	*Unknown*	158
51 N.G.91	*S. robustum*	162
Q.13	*S. officinarum*	80
Q.44	*S. officinarum*	80

In connection with the legume breeding programme some checks were made on varieties of cowpea (*Vigna sinensis*). All varieties tested showed 22 somatic chromosomes, including giant cowpea, which it was thought may have been a polyploid.

Legume Breeding

The legume breeding project, commenced in 1955, was continued, and a number of crosses made between varieties of cowpea (*Vigna inensis* Endl.). Varieties used in crosses included Groit, Poona, Reeves, and the following varieties received from the Commonwealth Plant Introduction service : 8085, 8086, 9247, 9259, 9432, 11044 (Malabar Pea), 12153, and 12377 (Black Eye 5). Numbers 9259, 12153, and 12377 are reputed to be resistant to the wilt caused by *Phytophthora*, sp. and for that reason were used extensively as parents. Seed from crosses was collected and propagation for selection is now being carried out.

Fig. 50—Working in the legume breeding plots—Meringa, 1956.

Together with the cross pollination of the cowpeas, observations on bean fly (*Agromyza phaseoli* Coq.) susceptibility were made and the following classification of the varieties resulted:—

Resistant—Clay Pea.

Highly Tolerant—Cristaudo, Giant, Malabar, Reeves, 9248.

Tolerant—Victor, 9247, 12377.

Susceptible—Brabham, Groit, Poona, Q.30, Q.31, 8085, 8086, 9259, 9432, 10753, 12153.

Fig. 51—The Meringa glasshouse after the cyclone.

In addition to the crossing of cowpeas it is proposed to carry out some cross pollination of velvet beans (*Mucuna* spp.) in the coming year. Some sixty varieties of different legumes were obtained from the Commonwealth Scientific and Industrial Research Organisation for the purpose of selecting parental material for the development of further legumes for the industry. Of those tested, apart from cowpeas, the most promising are strains of *Phaseolus aureus*, *P. mungo*, *P. radiatus*, *P. riccardianus* and *Dolichos lab-lab*.

Varietal Statistics

Due to an unfavourable season throughout most of coastal Queensland the total tonnage crushed was one and a quarter million tons below that for the previous year. The decrease in crop occurred in every part of the State and appeared to be largely associated with the extended period during 1955 when photosynthetic processes were slowed up due to lack of light. A contributory factor was undoubtedly the fact that on many farms less fertilizer was used owing to the fear of overproduction.

Q.50—Premier Variety for the Third Time

For the third year in succession Q.50 achieved the honour of being premier variety of the State. This year, however, the variety Pindar has made tremendous progress and with a production of 2,300,000 tons was only 300,000 tons short of the 2,600,000 tons produced by Q.50. In the 1956 season Pindar could possibly have attained premier place but for the cyclone "Agnes" which decapitated thousands of acres of it from Mackay to Mossman and so decreased its yield that it can scarcely be expected to produce a crop comparable with that of the relatively unaffected Q.50. Furthermore, owing to the wind damage Pindar sustained, many farmers have decreased their plantings of this variety so that it seems likely that the tonnage of it harvested in 1955 may be the highest Pindar will ever reach. Likewise Q.50, although it is still extending in the southern part of the State, must gradually recede in importance now that Q.58 is gaining impetus in the central district, while in future

Fig. 52—One end of the glasshouse was repaired to allow seedling raising this year.

years Q.56 and Q.63 will make further inroads into the plantings of it. There are also signs that Q.50, due to harvesting problems. has already passed its peak in the northern districts.

Trojan has assumed a steady third position which it seems likely to maintain for some time owing to its high sugar content late in the season. Indeed, it is not impossible that in the near future Trojan might again occupy one of the first two positions in the State. Since large stocks have been hot water treated to free it from ratoon stunting disease its ratooning qualities have improved immensely and its resistance to wind damage this year has given it a further burst of popularity.

Fig. 53—Planting one of the seedling experiments at Meringa.

C.P.29/116 retained its fourth ranking position with a little more than ten per cent. of the total crop. Although much of this variety has been replaced in the Bundaberg district with Q.50, C.P.29/116 is now being planted to some extent at Mackay and this has helped to maintain its relative position in the State's crop.

The decline of Badila plantings continued even though some really fine crops of this variety are now being grown in the far north from hot water treated stocks. At six per cent. of the total crop it was fifth in importance in the 1955 crop, but the 527,000 tons it produced was 240,000 tons less than it produced in 1954. Eros, Q.47, Comus, S.J.16, and Q.44 occupied the next five places, but are well down in the scale of importance with Eros at the top with only one quarter the production of Badila.

Rise of Q.57

Although new varieties are being continually introduced into the industry, every few years one such variety makes a sudden leap to major importance. During the past ten years this has happened with Trojan, Q.50 and Pindar. Now the new variety Q.57, which has jumped from 32nd place in 1954 to 11th place in 1955, is making its bid for a place as a major variety. Estimates now to hand for the 1956 crushing indicate that it will probably reach sixth position in the State in 1956, and might well replace Badila as fifth variety by 1958. Q.57 has been planted very extensively in the Burdekin, Mossman, Mulgrave and Babinda districts. Its favourable early sugar content in years when other varieties have shown a low sugar content, and its resistance to cyclonic winds, have helped to bring about its popularity.

Fig. 54—The difference in size in different flats of seedlings illustrates the extended period over which experimental plantings are made at Meringa.

Lesser Varieties

Of the varieties of lesser importance, Q.28 has fallen from tenth position to thirteenth, being displaced by Q.44, Q.57, and Q.55. P.O.J.2878 has also fallen two places from twelfth to fourteenth and its harvest dropped from 89,000 tons in 1954 to 53,000 tons in 1955. Q.55 is a variety which yields well in the drier parts of the southern district and for the first time produced a larger tonnage than P.O.J.2878. N.Co.310 has made a fairly

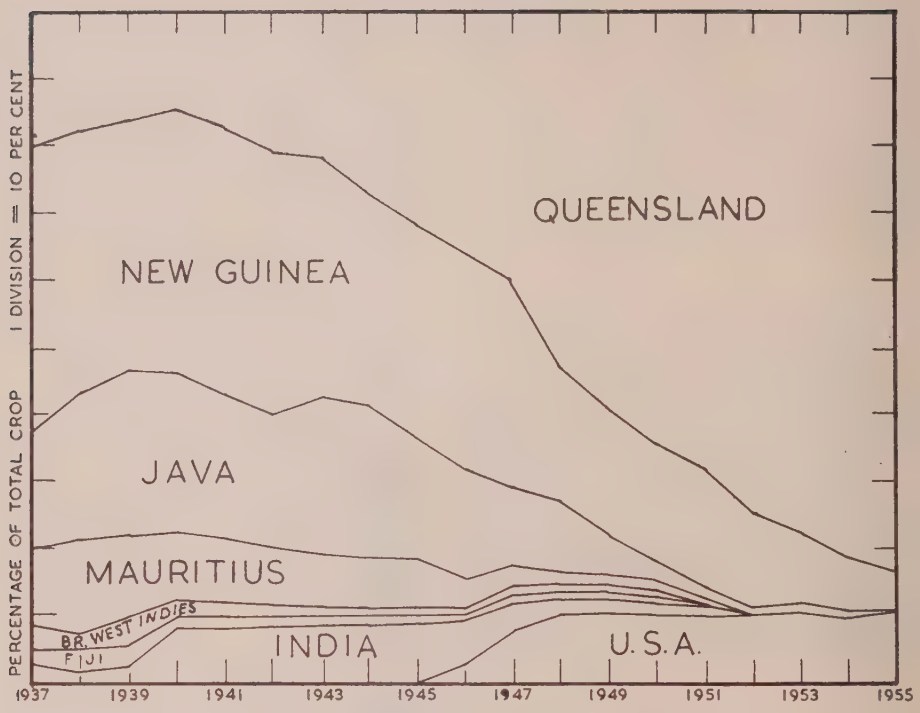


Fig. 55—The composition of the Queensland crop on the basis of country of origin from 1937 to 1955.

rapid rise from twenty-sixth place to seventeenth and is now responsible for some 45,000 tons. Likewise, Q.58 is extending in the central district and about 20,000 tons of it were crushed in 1955. In 1956 there should be a very much larger tonnage of this variety harvested. Q.58 was listed for the first time this year and has already passed such formerly important varieties as E.K.28 and Clark's Seedling. The latter variety appears to be well on the way out and only 14,000 tons of it reached the mills in 1955, compared with 329,000 tons ten years ago when it ranked as fifth variety in the State. Two varieties bred in recent years by the Colonial Sugar Refinery Co., namely, Vidar and Ragnar, have both achieved some popularity, the former in the Innisfail district, and the latter at Ingham, whilst Vesta has continued to find favour in parts of the southern district and is responsible for 47,000 tons of the crop.

Queensland Bred Canes Still Increase

The steady increase in the proportion of crop provided by Queensland-bred canes was maintained and the percentage increased by 1.4 to 81.7 per cent. The West Indies has dropped off the list of countries which contribute varieties to the Queensland crop as B.208 has fallen to such a low tonnage it is no longer recorded. The total cane provided by India, Mauritius, and Fiji together reaches only 0.2 per cent. of the total crop, and only the United States, with C.P.29/116 some 10 per cent. of the crop, and New Guinea, with Badila still 6.2 per cent. of the crop, show any appreciable representation. The Javanese representative, P.O.J.2878, has fallen in percentage from 1.1 in 1954 to 0.7 in 1955, whilst the South African representative N.Co.310 has shown an increase from 0.1 per cent. to 0.5 per cent. Likely changes in the future are a further percentage to South African cane, as N.Co.310 extends, and a possible increased percentage for Indian varieties if Co.475 achieves the status of an approved variety in North Queensland.

New Varieties

Q.59 was placed on the approval list for several northern mill areas in 1956 and is

showing great promise on the wetter soils. Extensive plantings of this variety have been made particularly in Babinda and Mossman. Q.64 is also being tested in the far north whilst I.233, which has not yet received a "Q" number, is the most promising variety yet produced by the Bureau of Sugar Experiment Stations for those rich lands on which all present commercial varieties lodge. In the central district Q.56 was placed on the approved list for Proserpine and Sarina in 1956, whilst Q.63 and Q.65 are being propagated rapidly with a view to approval in the near future. In the southern district two vigorous varieties, Q.61 and Q.62, are also being propagated rapidly for approval as soon as possible. New varieties are now being introduced to the industry in a steady stream and it is anticipated that in the next few years the varietal composition of the State will undergo many changes.

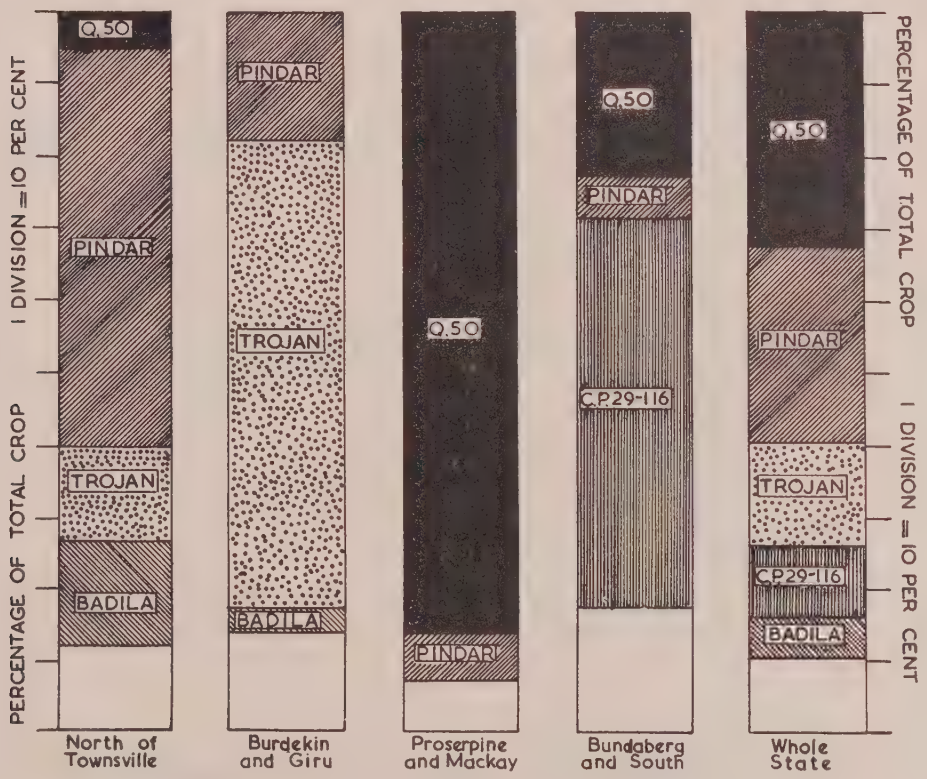


Fig. 56—Percentages of five major varieties grown in various parts of Queensland—1955 crop.

Table VII

Countries of Origin : 1955 Crop

Country of Origin	Tons of Cane	Per cent.
Queensland	7,035,564	81·7
U.S.A.	925,448	10·7
New Guinea	530,992	6·2
Java	61,051	0·7
South Africa	45,827	0·5
India	12,992	
Mauritius	2,470	0·2
Fiji	1,819	
	8,616,163	100·0

TABLE VIII.

List of Bi-Parental Crosses made during 1956 Season.

Badila	x Co.475, G.323, G. 362, I.211, Q.27.
Co.270	x Eros, M.336, 33 M.Q.371, P.O.J. 2878, Q. 36, 39 S.N.3821.
Co.281	x M.336, P.O.J.2878.
Co.290	x M.336, P.O.J.2878.
Co.364	x Eros, P.O.J.2878, Q.36.
Co.385	x M.336, Q.27, Q.39.
Co.475	x Badila, P.O.J.2878, Trojan.
C.P.29/116	x C.4-6, Krakatau.
D.209	x Eros, G.331.
D.285	x G.362, P.O.J.2940, Q.28, Q.B.54-8, Q.B.54-24.
Eros	x B.41-227, Co.270, C.P.36/138, C.P.44/155, G.331, M.336, 33 M.Q.371.
G.323	x Badila.
G.331	x Eros, Korpi.
G.362	x Badila, G.270, M.336, P.O.J.2878, Q.27.
H.32-8560	x Badila, G.269, G.362, Q.27, Q.39.
H.34-3171	x Badila, G.362, K.5, M.336, Q.28.
I.211	x Badila.
I.426	x Q.28.
J.337	x M.336, Q.36.
M.336	x Co.270, Co.281, Eros, G.362.
33 M.Q.371	x Co.270, Eros, Pompey.
N.Co.291	x Eros.
N.Co.292	x Eros.
Pepe Cuca	x Q.27.
P.O.J.2875	x Co.270, Eros, M.336, 33 M.Q.371.
P.O.J.2878	x Co.270, Co.281, Co.290, Co.331, Co.475, C.P.36/138, G.362, M.336, 33 M.Q.371, P.O.J.2940, Q.28, Q.B.54-12, Q.B.54-13, Q.B.54-15, Q.B.54-26.
Pompey	x 33 M.Q.371, Q.39, Uba Marot.
Q.27	x Badila, G.362.
Q.28	x P.O.J.2878.
Q.44	x Badila, G.362.
Q.50	x Q.36.
Q.59	x Badila, G.270, M.336, Q.28.
Q.61	x Q.27, Q.39.
Trojan	x Badila, Co.290, Co.331, Co.475, Eros, G.270, G.331, H.25, H.39-5803, I. 211, M.336, 33 M.Q.371, 51 N.G.95, Pepe Cuca, P.O.J.2878, Q.27, Q.28, Q.36, Q.B.54-24, 33 S.N. 1882.
Vidar	x Eros.

TABLE VIII (a).

Female Parentage of Seed Saved from Polycross, 1956 Season.

Badila	G.323	I.216	P.R.905
Co.270	G.324	I.426	Q.27
Co.281	G.331	J.331	Q.28
Co.290	G.362	J.337	Q.36
Co.364	H.32-8560	M.336	Q.39
D.209	H.34-3171	33 M.Q.371	Q.49
D.285	H.Q.409	P.O.J.2878	Q.50
Eros	I.106	P.O.J.2940	Trojan
G.263	I.209	Pompey	

Table IX

Varietal Composition and Distribution in the Four Main Districts and in the State as a whole — 1955 Crop

Variety	North of Townsville		Burdekin and Giru		Proserpine and Mackay		Bundaberg and South		Whole State	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
1. Q.50	161,112	4·8	17,697	1·6	2,043,005	85·6	379,030	22·3	2,600,844	30·2
2. Pindar	1,897,267	56·0	195,098	17·1	136,794	5·7	91,759	5·4	2,320,918	26·9
3. Trojan	438,089	12·9	721,756	63·3	14,556	0·6	2,208	0·1	1,176,609	13·7
4. C.P. 29/116 ..	—	—	—	—	42,069	1·8	883,379	51·9	925,448	10·7
5. Badila	485,197	14·3	38,104	3·3	3,798	0·2	—	—	527,099	6·1
6. Eros	124,643	3·7	—	—	—	—	—	—	124,643	1·5
7. Q.47	—	—	—	—	—	—	121,967	7·2	121,967	1·4
8. Comus	62,485	1·8	34,724	3·0	15,947	0·7	—	—	113,156	1·3
9. S.J.16	—	—	69,448	6·1	—	—	—	—	69,448	0·8
10. Q.44	67,266	2·0	—	—	—	—	—	—	67,266	0·8
11. Q.57	10,808	0·4	54,604	4·8	—	—	—	—	65,412	0·8
12. Q.55	—	—	—	—	—	—	60,151	3·5	60,151	0·7
13. Q.28	—	—	—	—	54,624	2·3	3,217	0·2	57,841	0·7
14. P.O.J.2878 ..	354	—	33	—	27,130	1·1	25,912	1·5	53,429	0·6
15. Vidar	52,760	1·6	—	—	—	—	—	—	52,760	0·6
16. Vesta	—	—	—	—	—	—	47,075	2·8	47,075	0·5
17. N.Co.310 ..	—	—	—	—	129	—	45,698	2·7	45,827	0·5
18. Ragnar	33,524	1·0	—	—	—	—	—	—	33,524	0·4
19. Q.58	—	—	—	—	19,588	0·8	—	—	19,588	0·2
20. Q.49	—	—	—	—	—	—	18,234	1·1	18,234	0·2
21. S.J.4	16,030	0·5	—	—	—	—	—	—	16,030	0·2
22. Cato	14,980	0·4	—	—	—	—	—	—	14,980	0·2
23. H.Q.426 ..	9,934	0·3	3,684	0·3	522	—	—	—	14,140	0·2
24. Q.45	—	—	—	—	12,671	0·5	—	—	12,671	0·1
25. E.K.28	—	—	2,828	0·3	4,794	0·2	—	—	7,622	0·1
26. Co.290	—	—	—	—	1,972	0·1	5,226	0·3	7,198	0·1
27. Q.51	—	—	—	—	—	—	6,539	0·4	6,539	0·1
28. Co.301	—	—	—	—	—	—	5,794	0·3	5,794	
29. Badila Sdg. ..	3,893	0·1	—	—	—	—	—	—	3,893	
30. M.1900 S. ..	—	—	—	—	2,199	0·1	271	—	2,470	0·2
31. Q.42	—	—	—	—	—	—	2,211	0·1	2,211	
32. S.J.2	—	—	689	0·1	1,435	0·1	—	—	2,124	
33. Pompey ..	1,819	—	—	—	—	—	—	—	1,819	
34. Expt. and Others	6,633	0·2	880	0·1	4,778	0·2	5,142	0·2	17,433	0·2
	3,386,794	39·3	1,139,545	13·2	2,386,011	27·7	1,703,813	19·8	8,616,163	100·0

Division of Entomology and Pathology

R. W. Mungomery, Asst. to Director

GENERAL

Staff

There was a general improvement in staff strength during the past year and it was pleasing to welcome back Mr. D. R. L. Steindl, Senior Pathologist, after a prolonged period of illness. Mr. Steindl resumed duty on 1st July, 1955, and since then he has been engaged mainly on investigations in connection with ratoon stunting disease. Mr. C. G. Hughes, Senior Pathologist, also returned in October, 1955, from an extensive overseas tour which embraced Great Britain, several of the European countries, United States of America, and Canada. There he was afforded facilities for visiting many of the more famous Universities and scientific organisations and for contacting leading pathologists and discussing with them some of the more recent developments in connection with pathological research. Mr. Hughes was also able to visit the sugar-growing areas of continental United States and Hawaii, and to assess the magnitude of the cane disease problems of those countries in comparison with those of our own. Mr. J. R. Pollock, Assistant Pathologist, resigned on 17th February, 1956, to take up an appointment with the Australian Paper Manufacturers Ltd., but this vacancy was filled by the appointment of Mr. O. W. Sturgess as Pathologist. Mr. Sturgess, who is a graduate in agricultural science of the Queensland University, was for the past six years attached to the Pathology Branch of the Queensland Department of Agriculture and Stock, and in that capacity he concentrated mainly on various diseases of certain horticultural crops.

Following on the more stable position of the pathological staff at Head Office, arrangements were made for the transfer of Mr. B. T. Egan, Assistant Pathologist, to Meringa, where he will be more closely associated with those cane diseases which are of particular importance to North Queensland. The scope of field investigational work in connection with the so-called *Verticillium* disease was expanded by seconding Mr. R. B. Moller, Assistant Agronomist, to work on this problem in the Bundaberg district. Mr. Moller was transferred from the Burdekin district at the end of June, 1955, and since then, in addition to investigating the problem from the agronomic angle, he has also collaborated closely with the pathologists in setting out a large number of field trials. Other duties undertaken by him include life history studies in connection with the Chrysomelid beetle, *Rhyparida dimidiata* which has caused localised damage to ratoons on a few farms in the Bundaberg district during the past few seasons.

General

The campaign against ratoon stunting disease was intensified by the gazettal of a further nine proclamations which made it obligatory on growers, except where authorised otherwise, to plant from disease-free stocks, and to destroy diseased cane after harvesting the second ratoon crop. These proclamations involved the following mill areas: Mulgrave, Babinda, Tully, Pioneer, Kalamia, Proserpine, Millaquin, Qunaba, Fairymead, Bingera, Gin Gin, Isis, Maryborough, and Rocky Point. Similar proclamations in respect of Inkerman and Plane Creek came into force last year, so more than half of the Queensland cane areas are now complying with the above requirements. It is expected that other proclamations for the remaining mill areas will be gazetted towards the end of 1956, so all plantings to be made in 1957 should be from disease-free material.

Although the presence of ratoon stunting disease in all Queensland cane areas was the immediate reason for promulgating restrictive measures against this disease, it still became necessary to enforce measures to keep other

Fig. 57—This is a photograph of the original experiment in 1946 in which BHC was used to control the grub of the greyback beetle. The middle rows were treated with BHC and the outside ones were not. In 1956, the tenth anniversary of this experiment, we reproduce this photograph.

"Large streams from tiny fountains flow
Tall oaks from little acorns grow."

major diseases under effective control; hence the opportunity was taken to embody in these proclamations similar restrictions against an additional number of major diseases in those districts where they occurred. These diseases included the following :—leaf scald, chlorotic streak, mosaic, sclerophthora, Fiji, downy mildew, and spindle stripe. In other cases, however, because of the eradication of certain diseases from various mill areas, five earlier proclamations became redundant and these, accordingly, were cancelled. They included the following:—Proclamations Nos. 5 (Bundaberg-Childers district), No. 16 (Fairymead mill district), No. 17 (Mossman mill district), No. 19 (Millaquin-Qunaba mill district), and No. 21 (Maryborough-Bauple mill district).

Undoubtedly one of the most serious setbacks in the clean-up campaign against disease resulted from a severe cyclone which struck the Queensland coast near Proserpine early in March, and which affected in varying degree most of the canegrowing areas from Mackay to Mossman. Much of the clean cane which had been reserved for this season's planting requirements was snapped off at the base, or at the top, or had its foliage stripped to such a degree that prolific side shooting occurred. Some growers were able to retrieve and plant some of this damaged cane, but it became necessary to afford others, less fortunate, some measure of relief, and they were given permits to plant from stocks that had not previously been hot-water-treated.

Because of the small percentage of setts that still retained the ratoon stunting virus after the 50° C./2 hr. treatment, it was found necessary to prolong the curative treatment for a further hour, and most Cane Pest and Disease Control Boards had substantial quantities of cane subjected to the 50° C./3 hr. treatment last year. Wherever this cane was planted under good conditions, good germinations followed. In addition, the Senior Entomologist checked the performance of a number of hot-water-treatment units, and where necessary submitted suggestions for their improvement. As a result, since most of the Boards have

assumed responsibility for the establishment each year of small nucleus stocks of clean cane, the standard of planting material now being distributed, insofar as freedom from disease is concerned, is far superior to that hitherto available.

Two somewhat disturbing features in the general disease position were the discoveries during the past year that chlorotic streak disease had shown up in cane crops in the Isis, Bundaberg, and Giru districts — three areas where it had hitherto not been recorded —and that downy mildew had re-appeared in Bundaberg, six years after the last record of a diseased stool having been destroyed there. Fortunately, the downy mildew outbreak was confined to one farm, and with the destruction of this focus of infection the eradication of this disease can confidently be anticipated. The prospects for eradicating chlorotic streak disease from all three centres are not so bright, particularly since low-lying wet fields are involved; however, this objective is being kept in the forefront and suitable restrictive measures have been enforced. Although one of these outbreaks may be closely associated with earlier illicit introductions of diseased planting material, the other two cases are not so simply explained. They could quite well involve the existence of the disease in an alternative host, and they serve to underline the importance that is now being attached to chlorotic streak investigational work.

It might be appropriate here to draw attention to the adverse influence which the system of proportional harvesting that is being followed in some mill areas is having on the general control measures against both diseases and pests. The intense competition engendered by this system amongst growers to produce and have in sight for crop estimates as high a tonnage as possible so that the final proportion accepted for harvest will still represent a high farm tonnage, has led many growers to reject the sound principles of agriculture and practise a minimum of fallowing. In some instances blocks are ploughed out and quickly replanted, while in other instances permits are sought for them to be stood over or ratooned for unduly long periods. Not only is this system the means of prolonging the period during which disease still remains on the farm to present a menace to the other clean fields, but it is also conducive to the build-up in South Queensland of dense grub populations which assuredly must cause severe losses in the years ahead ; in North Queensland, too, the serious rotting that occurs in standover crops, the damage caused by rats and beetle borers, and the high harvesting costs which this class of crop attracts in the following year, must render the production of crops greatly in excess of peak requirements, a doubtful economic proposition.

The annual Conference of Cane Pest and Disease Control Boards was held in Innisfail on 5th April, when some 53 delegates from 20 Boards, and a number of Bureau officers attended. This conference—the eighteenth—provoked informative discussions regarding the percentage germination obtained and the curative effect achieved from a series of time-temperature combinations in the hot-water-treatment of cane setts prior to planting. Another paper stressed the necessity for maintaining grub control with BHC, while small fluctuating populations were present in canefields adjacent to grassland and natural rain forest. Attention was drawn to a number of minor pests such as earth pearls and nematodes which were causing some damage in small localised areas. It was also shown that considerable savings could be effected without loss of attractiveness, by substituting an AB mill syrup for the ordinary golden syrup in the yellow phosphorus-syrup mixture which is spread on bread and commonly used for baiting rats.

Insect pests did not cause serious damage to the 1956 crop as a whole. The losses due to grubs totalled only 3,600 tons of cane as compared with 5,000 tons in the previous year, but there was some concentration of damage in individual mill areas, greyback grubs being responsible for a loss of 1,000 tons in one mill area, while frenchi grubs destroyed 1,500 tons

in another. Although the beetle borer was of minor importance, a slight increase was noted in three mill areas. Wireworms, army-worms, termites and earth pearls were of minor importance, but the latter were of interest since infestations were noted and specimens collected for identification in hitherto unrecorded localities in central and far northern districts. The invasion of several districts by the spur-throated locust in 1954 resulted in the emergence of young hoppers during 1955, but these did not materially affect the cane crop.

A final assessment of the damage caused by animals and birds can not be made since damage may continue in crops not yet harvested. It is anticipated that damage caused by rats in 1956 will be much less than in the previous year. A good supply of natural vegetation minimised the invasions of cane fields by wild pigs and wallabies, but control of the latter was maintained by the use of beagle hounds and by the destruction of over 3,000 of these marsupials in and near cane fields in the central districts.

More detailed reports on individual pests and diseases are given in the following pages by the Senior Entomologist and Senior Pathologist respectively.

Entomological Investigations

(G. Wilson, Senior Entomologist)

THE GREYBACK CANE BEETLE *Dermolepida albohirtum* Waterh.

Emergences of beetles were again light in most northern areas. Concentrations were observed in November, 1955, at Codfish Creek and Woopen Creek in the Babinda area and at Miallo and Saltwater Creek near Mossman. The presence of grubs in small numbers in field trials at Innisfail indicated that beetles had emerged in that area. Since this pest was brought under virtually complete control by the use of BHC, beetle emergence has lost its dire significance for canegrowers and it is probable that other small emergences occurred but were unobserved in the evening twilight. On five soil insecticide trial sites in the Innisfail district infestations averaged 0.9 grubs per stool as compared with 0.74 in the previous year on similar, but not identical, sites. In both years bandicoots (*Perameles* spp.) had partly depleted the infestations before the inspections were made.

Loss of Cane Due to Grub Damage

The cane destroyed by greyback grubs throughout the State was assessed at only 1,480 tons on 472 infested acres, as compared with 2,480 tons (290 acres) in 1955, and 1,000 tons (224 acres) in 1954. The total loss in the 1956 crop may prove slightly greater than reported because damage was still developing in the Burdekin district in July. A Burdekin mill area suffered the highest individual loss amounting to 1,000 tons on 300 infested acres, representing an increase of 200 tons on the previous year's loss, while in an adjoining area the loss decreased from 1,590 tons in 1955 to 10 tons in 1956. Some losses can be expected to continue in those districts where grub infestation is unpredictable and BHC not widely used.

Trials with Insecticides Against Grubs

In field trials the insecticides aldrin and dieldrin were compared with BHC for grub control, and formulations and methods of application of BHC were studied with regard to grub control and the effect on soil fertility. The volume of data obtained was again limited by the low levels of grub infestation on many trial sites.

Refined versus Crude BHC

The residual protection conferred on second ratoons by application of refined and crude BHC applied on the plant crop was compared in two dispersed replicates. The two formulations, prepared from BHC containing 60 per cent. and 13 per cent. of the gamma isomer, were equally effective. Six other replicates were not grub infested.

BHC Retreatment Trials

Single applications of 75 and 100 lb. of 20 per cent. BHC dust per acre on the plant crop were compared with similar amounts divided into plant and first ratoon dressings. In two first and one second ratoon crops which were infested by grubs no significant difference in yield was obtained from either the higher rate or the divided applications. In another second ratoon crop the lighter single dressing yielded 17.8 tons per acre as against 21.5 from the higher rate. Divided applications outyielded single applications by 3.3 and 3 tons per acre at the lower and higher rates respectively.

Long Range Soil Toxicity Trials

The long range investigation into the effect of various amounts of crude and refined BHC on soil fertility was continued in the harvest-

ing of two second ratoon crops, at Bundaberg and Babinda. The yields at Bundaberg supported the plant and first ratoon results which were tabulated in the 1955 report and which disclosed no effect on either yield of cane or sugar content. At Babinda the mean yield from the untreated controls was 21.66 tons of cane per acre; plots on which varying amounts of BHC had been applied gave a mean

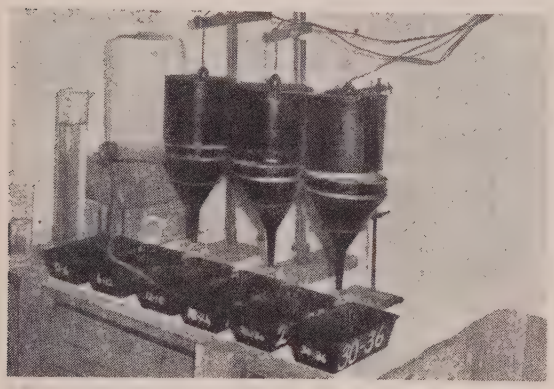


Fig. 58—Tullgren apparatus in use collecting minute soil fauna from soil samples.

yield of 20.0 tons per acre. That overall difference was significant at the one per cent. level, but the comparative yields from individual treatments with lower and higher rates of BHC were inconsistent with any deduction that BHC *per se* had affected soil fertility.

New Insecticides for Grub Control

Aldrin and dieldrin were applied in 1953 on plant crops in dispersed single replicate trials at 2, 4, and 6 lb. per acre, for comparison with 2 lb. of gamma BHC per acre for grub control. The plant crops were not grub infested. In the first ratoons two replicates sustained infestations averaging 1.75 and 2.8 grubs per stool. These infestations would have caused serious damage to unprotected cane on the red volcanic soils involved. No grub damage appeared on the plots treated with the new insecticides and the yields were comparable with those resulting from BHC. However, further replication of these results, particularly at the lower levels of application, is required before a final comparison with BHC can be made. The possibility of aldrin filling a dual role in controlling both the funnel ant and the greyback grub gives added interest to the outcome of these trials.

Fig. 59—Studying life history of Margarodes, February, 1956.

FRENCH'S CANE BEETLE, *Lepidiota frenchi* Blkb., AND ALLIED SPECIES

Beetle Emergence and Damage to Crops

The two-year life cycle of *L. frenchi* and of the allied species *consobrina* and *caudata*, implies that when large populations occur they are likely to reappear at two-yearly intervals until controlling factors disturb the rhythm. The heavy emergences of 1953 were repeated in the Mulgrave district in 1955. Beetles emerged in large numbers in December, 1955, in several localities between Highleigh and Fishery Creek, and still heavier flights took place, early in January, 1956, and persisted into February. *L. consobrina* emerged in large numbers on the Beach Road near Mossman in October. Only minor flights of *L. caudata* were noted, near Frenchman's Creek, Babinda.

Cane destroyed by frenchi amounted to 2,200 tons on 237 infested acres, a high proportion of which, 1,500 tons (140 acres), was

in Mossman. Some fields of plant cane were affected, including at least one which had been replanted immediately after being harvested, emphasising the advisability of applying BHC at planting time in certain areas. Damage occurred in ratoons where BHC had not been applied. In a few instances *L. consobrina* caused damage to ratoons following the application of BHC on the plant crop. It appears necessary to investigate whether that species is less readily controlled by BHC than is the frenchi grub. Frenchi infestation caused some loss in a restricted section of the Tully area, in which the species has never been widely distributed; but, on the other hand, Mackay, which suffered considerable loss in the past, recorded almost no damage for the third year in succession.

Following storm rains, the first heavy flight of *L. trichosterna* Lea at Bundaberg and of *P. furfuracea* Burm. in the Isis area occurred in mid-December. Further storms in January preceded a second flight in both districts. Damage at Bundaberg was not generally extensive, although Waimea plantation experienced considerable damage from a mixed infestation of *L. trichosterna* and *L. frenchi* At Coonarr Beach near Bundaberg, a hitherto unknown grub, which caused much damage in the sandy soils over the years, has now been identified as *Rhopaea mussoni* Blkb., and similar small patches of heavy grub damage on sandy soils in the Bli Bli and Didillibah areas of the Moreton district appear to implicate this species also. The growing practices of carrying a large proportion of standover in the Isis district and of ratooning for unduly long periods are undoubtedly responsible for the heavier infestations of *P. furfuracea* which have caused some severe losses there this year.

Field Trials with Insecticides

In North Queensland, aldrin and dieldrin were applied on the plant crop in 1953 in three exploratory trials, for comparison with BHC for frenchi grub control, but the low infestations encountered did not cause significant loss in the untreated controls and no information was obtained. Trials with BHC to determine the optimum dosage on the plant crop to provide residual protection of the second ratoons do not appear to carry, in 1956, a sufficient number of young grubs to yield the desired information in the 1957 harvest.

Further attempts have been made to control *P. furfuracea* with some of the newer insecticides, and a number of trials have been set out in the Isis district using 20 per cent. and 40 per cent. BHC, aldrin and dieldrin applied at various levels both as row and blanket dressings. No results have been obtained to date from these experiments, but it should be borne in mind that the control of *P. furfuracea* is unlikely to be achieved at low treatment rates. For this reason growers should not lightly reject the less costly method of reducing grub populations by using the high speed rotary hoe when infested fields are to be ploughed out and prepared for planting again after a normal fallow.

Use of BHC for Grub Control

The total acreage on which BHC was applied in the 1956 crop, 33,246 acres of plant cane and 3,358 of ratoons, showed a slight decrease from the 34,091 acres of plant and 4,661 of ratoons treated in the previous year. The trend varied from district to district. In one mill area the acreage treated increased by 1,100 acres, due chiefly to applications having been limited by adverse weather in the previous year. In another district the use of BHC has been notably influenced by sporadic infestation; following a sudden increase in grub damage in 1952 the area treated was approximately doubled in the ensuing two crops, but applications had decreased in 1955 to the 1952 level and a further decrease of 1,400 acres took place in 1956.

The Funnel Ant, Aphaenogaster pythia, Forel

Excavations disclosed that male and female winged forms, soldiers, workers, pupae and eggs tended to be concentrated in the upper fifteen inches of soil under the cane stools. They also occurred in horizontal tunnels and enlarged chambers connected with the vertical tunnels which continued to a depth exceeding three and a half feet. Winged forms were found at Mossman in May, 1955, and at Tully in January, 1956. In order to study the habits of the ants without the necessity for frequent extensive excavation, complete cane stools with colonies were transferred to an observation cage, but failed to survive. Foodstuffs comprising finely divided cereals and meat-meal were offered, with the object of developing a toxic bait, but without success. An unidentified *Eurybrachid* was found in tunnels at Mossman and Tully, but there was closer association between the ants and a *Cicadellid* identified as a new genus *Penthimiini*, which the ants carried away to safety when disturbed. Soil insecticides applied on the plant crop gave, without further treatment, increased yields in the first ratoons. Chlordane had been applied above the setts at planting time at 2, 4, and 8 lb. per acre; aldrin was applied in similar amounts in the half open drill when supplies became available, four months later. Gamma BHC was applied at planting time and in the half open drill at the rate of 1.95 lb. per acre, in the form of a 20 per cent. crude

Fig. 60—Funnel ant mounds and poor ratooning in young first ratoon Pindar, Tully, July, 1956.

Fig. 61—Funnel ant mounds at base of stools of mature second ratoon Pindar, Tully, July, 1956.

BHC dust. A progressive increase in yield from the heavier rates occurred only in the first ratoons in the chlordane-treated plots, but the increments were not significant; therefore the yields have been summarised in the Table below according to the insecticides used.

The increase due to aldrin both in the plant crop and in the ratoon crop was significant at the one per cent. level. The increases due to chlordane and BHC were significant at the five per cent. level.

It is unfortunate that cyclone damage has rendered the second ratoon crop unsuitable for a further comparison of the yields.

These drill applications only partially controlled the ant populations; further trials have been set out in which drill and broadcast treatments are being compared, utilising a wider range of insecticides.

Earth Pearls, Margarodes, spp.

Margarodes, which have been observed in local heavy infestations in the Bundaberg district in past years, were found at Mackay, Ingham, Tully, Babinda, Mulgrave, and Mossman. At Mackay, Tully, and Mossman the *Margarodes* were associated with poor growth and death of stools, but the possibility of other factors having contributed to these effects has not been eliminated. No loss of yield has

EFFECT OF APPLYING VARIOUS INSECTICIDES FOR FUNNEL ANT CONTROL

Plant and First Ratoon Crop Yields:—Tons of Cane per Acre

Number of Replicate Plots.	Insecticide Used.	Yield.		Increase in Yield over Control.		
		Plant.	Ratoon.	Plant.	Ratoon.	Combined.
12	Aldrin	38.5	27.2	6.1	4.0	10.1
12	Chlordane	35.7	27.1	3.3	3.9	7.2
8	BHC	37.2	25.4	4.8	2.2	7.0
8	Untreated Control	32.4	23.2			

been detected at Babinda; and yield data were not available at the other centres because of the infestations being found in fallow fields. The differing solubilities and appearances of the tests of the pearls indicate that several species may be involved.

***Beetle Borer, Rhabdoscelus obscurus* Boisd.**

Although the beetle borer did not cause measurable loss, increased incidence was noted in three mill areas. If the control conferred by pre-harvest burning is to remain effective,

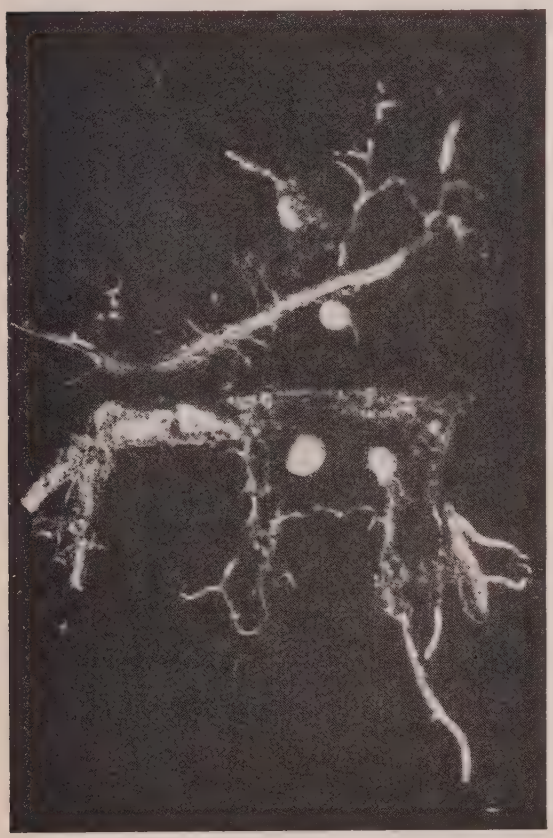


Fig. 62—White "earth pearls" (Margarodes) attached to cane roots at Mackay, December, 1955.

care will be required in the disposal of solid cane residues resulting from irregular topping, and stalk breakage caused by cyclones and animal pests.

Army Worms

Minor infestations of the larvae of *Leucania (Cirphis) unipuncta* Haw. in several districts in the spring months and one occurrence of an unidentified species of army worm in Mulgrave during May did not cause any apparent loss of crop.

Wireworms

In the central districts, where *Lacon variabilis* Cand. is a potential threat to germinating setts, newly planted crops were widely protected by the use of BHC-fertilizer mixtures; however the general level of wireworm infestation during the past year was low, and although four trials involving different amounts of aldrin, dieldrin, and BHC were established in typical wireworm country, the damage sustained in the control plots was so light that it was not possible to assess the relative values of aldrin and dieldrin against BHC, which is the standard used for wireworm control in Queensland canefields.

Wireworms were more prevalent than usual in parts of the Herbert River district, but there is no record of particularly serious damage having occurred.

Rhyparida spp.

Spotty damage to young ratoons caused by grubs of *Rhyparida dimidiata* Baly occurred on a few farms in the Lovers' Walk area of the Bundaberg district, and it is likely that *Rhyparida morosa* Jac. was also implicated to a lesser extent.

Field observations are being pursued in an attempt to work out life history details of *R. dimidiata* and observations to date indicate that these beetles were plentiful under loose bark of the Moreton Bay ash in mid-January. Others were found on mahogany, blue gum, and ti-tree, but most of them had disappeared by the end of that month. Larvae of various stages were found in and around cane stools in February, but neither the larval nor the adult stage was seen in May; however very young larvae were again located in July at depths of 8-10 inches.

Various field trials with aldrin, dieldrin, and BHC applied (1) as a row dressing and (2) as a broadcast dressing either ploughed under or disced in, were set out in plant fields that are likely to become infested, but as yet it is too early to anticipate results.

Scale Insect

Small infestations of the sugar cane scale, *Aulacaspis madiunensis* Zhnt., were located on Pindar plant cane and on Vesta standover in the Isis district. Similar infestations on Pindar on at least two farms in the Herbert River district have extended the range of this pest beyond the previous known northern limit of Mackay.

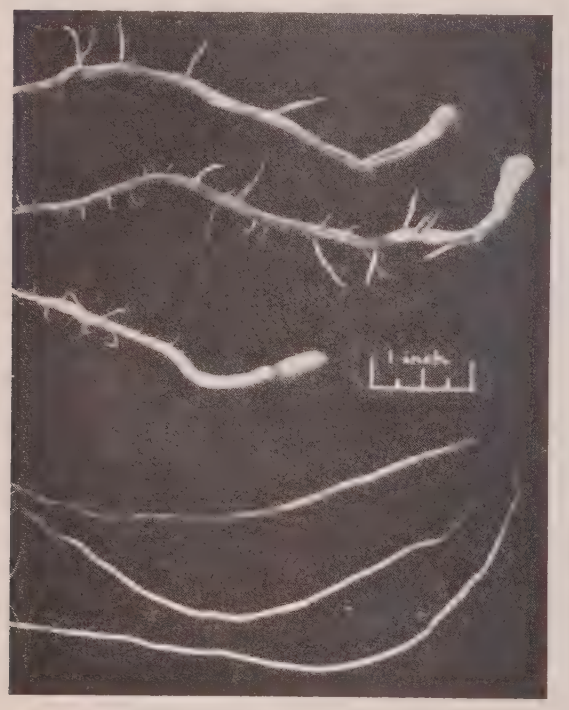


Fig. 63—Roots of C.P.29/116. Top three are infested with the root-knot nematode, Meloidogyne javanica; bottom three are normal, uninfested roots. Mullet Creek, near Bundaberg, February 1956.

Nematodes

Two fields of cane in the Mullett Creek area of the Bundaberg district were found to be badly affected by the root-knot nematode, *Meloidogyne javanica* (Treub) Chitwood. The superior resistance of the variety Co.290 over C.P.29/116 was clearly apparent, while the variety Pindar was also affected. It is proposed to establish a varietal resistance trial on one of these fields when it is being replanted in 1957. Minor infestations at Calavos, Bundaberg, involve another species, *Meloidogyne acrita*, variety *incognita* Chitwood.

Microscopic Soil Arthropods

The estimation of the numbers of small insects, mites, and other arthropods in the soil at different depths and under varying seasonal conditions was continued at Meringa throughout the year. Analyses were made periodically of the moisture, organic matter, acidity, and mineral fertility on three soil types being examined. An interesting sidelight on these investigations comes from Louisiana where increased yields obtained by applying chlordane on heavy soils are attributed to the effect of the insecticide on the microscopic soil fauna, since no other explanation is apparent. Chlordane and other insecticides are being used in trials in North Queensland to see whether increases can be obtained under similar circumstances.

ANIMAL AND BIRD PESTS

A marked increase in rat damage in almost all central and northern districts resulted in a loss of approximately 60,000 tons of cane in 1955. Losses were estimated at 11,000 tons in each of two mill areas, and from 2,000 to 9,000 tons in a number of others. In the Burdekin areas rats were of very minor importance, but in South Queensland they affected some of the heavier crops along the banks of the Kolan, Burnett, and Maroochy Rivers. Although considerable damage may yet occur before the completion of harvest, it appears certain that rat damage to the 1956 crop will be on a greatly reduced scale. Following the

extensive damage in 1955 increased supplies of poison baits were made available to growers by Cane Pest and Disease Control Boards.

Wallabies caused only minor damage. Although very numerous in the Central districts, where over 3,000 scalps were received by one Cane Pest and Disease Control Board, a good season kept them supplied with natural grass, thereby reducing crop losses. Those that approached the cane fields were harried by hunters and beagle hounds.

Fig. 64—Various species of mites and a springtail revealed by the microscope during soil fauna investigations of cane fields (Magnification x 23).

Wild pigs destroyed some hundreds of tons of cane in several far northern areas. In one district the damage increased noticeably after the cyclone, possibly because the natural feeding grounds were obstructed by a mat of fallen timber.

Bald coots, *Porphyrio melanotis* Temm., were again harmful to cane near swampy regions in the Mourilyan area, and white cockatoos, *Kakatoe galerita* Lath., destroyed an appreciable amount of cane on the outskirts of the Proserpine area and caused slight loss at Giru. The shining starling, *Aplonis metallica* Temm., which has caused damage near Silkwood in recent years, returned this year, but in small numbers.

Where cane fields abut on rain forest appreciable damage is done to mature cane by nocturnal feeders which defy detection. The damage is variously attributed to species of birds and to the Queensland striped phalanger, *Dactylopsila picata* Thomas. It is possible that more than one species of the native fauna are attracted by the succulent sweetness of the cane.

Disease Control Studies and Transmission Experiments

The current series of disease transmission experiments was concluded without any evidence being obtained of the transmission of either chlorotic streak or ratoon stunting disease by an insect.

In August and September hot-water-treatment tanks were inspected at all centres from Ayr to Nambour and at Goondi. In tanks approximating to the design prepared by the Bureau, and fitted with equipment for immersing the batch of cane simultaneously, the temperature could be controlled with a high degree of precision from within two minutes of immersion. After the temperature had been stabilised it rarely varied in the various parts of a tank at any one time by more than 0.2 degrees centigrade.

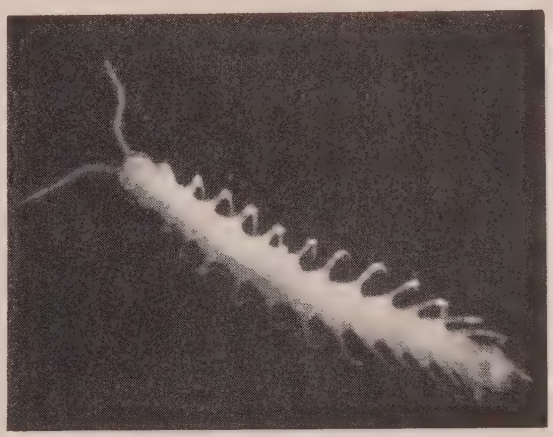


Fig. 65—A minute soil myriapod found in canefield soil (Magnification x 20).

The thermostatic steam control valves of moderate cost used up to the present time, whether operated directly or through an electric relay, do not control temperature as accurately as the manual operation of steam valves, and have suffered mechanical failure to the extent that it is doubtful whether the cost of installation is justified, even as a precaution against the temporary absence of the operator.

Some tanks were fitted with heating and circulation equipment which created a temperature gradient across the tank of up to 0.5 degrees centigrade, which was undesirable in view of the adverse effect of small increases in temperature on germination. On the other hand, part of the batch of cane might be treated at a sub-standard temperature in the cooler area of the tank. Tank operators were, however, competent and vigilant; consequently sub-standard temperatures were being avoided.

Where the baskets of cane were loaded into the tank consecutively, singly, or in small groups of up to three, the stabilisation of the temperature inside the containers was invariably delayed. To ensure treatment for the stipulated time at the correct temperature, the delay should be added to the time of immersion, but it was not practicable in routine operation to measure the delay, which varied up to thirty minutes from basket to basket and from batch to batch. The addition of this time-lag was therefore subject to the discretion of the operator. While there is no evidence available that germination or cure has been adversely affected by this factor, possible causes of lack of cure in the future will be obscured by the reduced precision in treatment.

Disease Investigations

C. G. Hughes, Senior Pathologist

Ratoon Stunting Disease

Further results from the ratoon stunting disease yield trials laid out in 1953 and 1954 have confirmed earlier observations that several of the more important commercial varieties such as N.Co.310, Pindar, P.O.J.2878, Q.47, Trojan, and Vidar can suffer serious losses from the disease. Q.57, S.J.4, and S.J.16 also showed some sensitivity while Badila, C.P.29/116, Comus, Q.50, and Q.56 appear to be least affected by the disease.

The cane and sugar losses set out in the table indicate that, of the fourteen varieties listed, the important North Queensland variety Trojan suffered the greatest losses in the trials. However, there were also highly significant losses in other varieties both in the averaged results and in individual trials. The losses recorded are not generally as great as those for the variety Q.28 (see C. G. Hughes and D. R. L. Steindl "Ratoon Stunting Disease of Sugar Cane," Bur. Sug. Expt. Stat., Tech. Communication, 2, 1955) which showed an average loss of 22 per cent. in the plant crop and 60 per cent. in the ratoons, but analysis of the growing conditions prevailing show that the Q.28 trials suffered a dry spring and early summer, while the years 1953 and 1954 were particularly favourable for cane yields. It is considered that under similar conditions, some of the varieties recently tested would suffer as severely as Q.28.

It is pleasing to note that Q.50 continues to show a high degree of tolerance to the disease.

Percentage losses of cane and sugar due to ratoon stunting disease

Variety.	Crop.	Number of Trials.	Average Percentage Loss.	
			Cane.	Sugar.
Badila	Plant	5	3.2	5.0
Badila	Ratoon	1	10.0	12.3
C.P.29/116	Plant	3	3.7	3.7
Comus	Plant	3	..	..
Comus	Ratoon	1	..	1.1
N.Co.310	Plant	2	15.2	13.7
N.Co.310	Ratoon	1	15.2	15.7
P.O.J.2878	Plant	2	13.2	14.9
P.O.J.2878	Ratoon	1	12.1	13.8
Pindar	Plant	14	9.3	7.3
Pindar	Ratoon	4	19.1	17.7
Q.47	Plant	3	8.8	5.8
Q.50	Plant	6	4.3	0.9
Q.50	Ratoon	3	4.4	4.8
Q.56	Plant	1	..	..
Q.57	Plant	2	6.0	3.2
S.J.4	Plant	2	15.1	12.1
S.J.16	Plant	4	3.8	5.9
S.J.16	Ratoon	1	12.9	14.8
Trojan	Plant	15	9.7	9.9
Trojan	Ratoon	5	25.5	26.4
Vidar	Plant	3	9.3	11.4
Vidar	Ratoon	1	21.9	22.6

In only one trial out of six did it show a significant loss in the plant crop, while in only one trial out of three was there a significant loss in ratoons.

C.c.s. determinations were carried out on all trials, and although there was some variation between healthy and diseased plots in individual trials, the general indications were

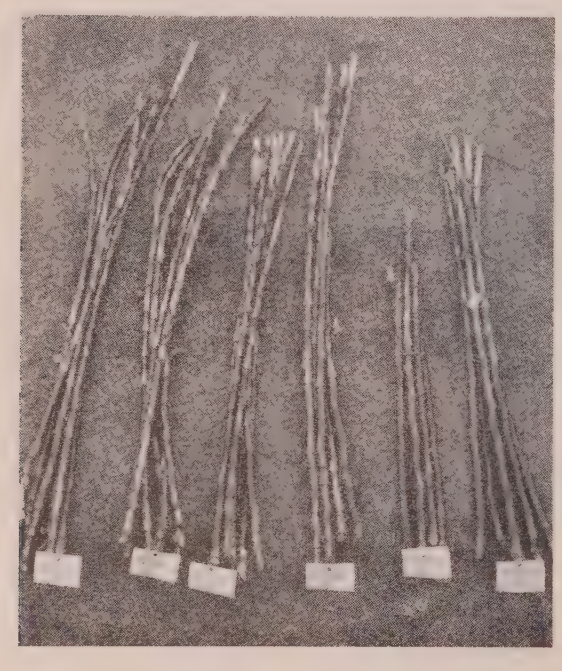


Fig. 66—Groups of stalks from a North Queensland ratoon stunting disease yield trial. Left to right, Q.50 diseased and healthy, Pindar diseased and healthy, and Trojan diseased and healthy.

that the disease had little or no effect on sugar values. Figures in the table bear this out in that the proportionate losses of cane and sugar as a result of the disease are approximately equal.

A further series of hot-water treatment trials using various combinations of time and temperature for the control of ratoon stunting in several varieties, was set out during the spring at each of the four Experiment Stations. Treatments used in these trials were as follows:—

49° C. for 2½ hours and 3 hours.

50°C. for 2 hours, 2½ hours, 3 hours and 4 hours.

51°C. for 2 hours, 2½ hours and 3 hours.

52°C. for 2 hours.

The setts for each variety were divided into thick and thin for each treatment in an attempt to determine whether the thickness of setts had any effect on the curative treatment. In order to avoid any overlapping of the two classes, setts were selected so that there was a difference of at least one-quarter inch between the thickest of the "thin" group and the thinnest of the "thick" group. Approximately 50 setts were used for each treatment.

Germinations at the various time-temperature levels varied somewhat from one district to another; for example, Trojan gave a much better germination at Ayr than it did at Meringa. Also some varieties withstood the heat treatment better than others. Badila, C.P.29/116, Pindar, Q.28, Q.47, Q.50, and Q.59 germinated best, while P.O.J.2878, Trojan and Vesta were the poorest. However, germination of all varieties was reasonably satisfactory, and in most cases there were fair germinations even at the higher time-temperature combinations. Results generally confirmed last year's findings in that germinations were quite satisfactory at treatments up to three hours at 50°C. and two hours at 51°C. Treatments for two and a half hours and three hours at 51° C. and two hours at 52° C. tended to cause a serious falling off in germination. It is of interest to note that relatively good germinations were obtained at 50° C. for four hours; also that in many instances, the thick setts gave a better germination than the thin ones, and at Bundaberg the overall vigour of the young crop was better in the thick-sett plots than in the thin-sett plots.

No final assessment of disease control has yet been made as current trials have not yet shown satisfactory symptoms. However, as a result of last year's trials it has been recommended that a treatment of 50° C. for three hours should be used for all commercial plantings, and this was adopted during the past planting season. Some cane which received this treatment during last winter failed to germinate, or germinated very poorly, but cane treated in the spring and planted under good conditions usually gave satisfactory germinations. The above trials were planted during the latter period, and it appears that, provided the cold winter months are avoided and good conditions exist for planting, a satisfactory germination will result after treatment at 50° C. for three hours.

Fig. 67—Overseas visitors at the Pathology Farm, June, 1956.

The research programme on ratoon stunting disease at the Pathology Farm has been hampered by the excessively wet weather which prevented experimental plantings during the latter part of summer and autumn, and by the poor development of internal symptoms, particularly in immature cane. Most plantings made in the winter of 1955 developed satisfactory symptoms in the spring, but later plantings which should have shown immature symptoms during the January to March period failed to do so.

An attempt was made to determine the age and length of stalk which best show the immature symptoms. Six hundred setts of Q.28 were inoculated with freshly-expressed diseased juice and planted in six plots each of 100 setts. Examinations of the primary shoots were made at about two-weekly intervals in successive plots, commencing 21 weeks after planting. The percentages of shoots showing positive symptoms at each examination, together with the average length of the stalks, are given in the following table.

Table

Immature symptoms of R.S.D. in primary shoots

Age in weeks	21	23	25	27	29	31
Length of stem (inches)	2.1	2.2	3.1	4.2	7.6	11.7
Per cent. shoots showing symptoms	75.9	71.4	81.8	85.7	89.1	73.7

It will be seen that the number of primary shoots showing positive symptoms reached a maximum at 29 weeks after planting when the average stem length was 7.6 inches. The overall percentage of plants showing symptoms at maturity was 97.3, which indicates that all plants infected with the disease do not show immature symptoms. Other experimental work has also indicated that plants inoculated with small doses of virus do not show immature symptoms, although they do become infected.

Further attempts have been made to prepare a sufficiently pure and concentrated preparation of the ratoon stunting disease virus for use in serological work, or for detection by means of the ultraviolet spectrophotometer. Inoculations have been made with these extracts, and it is hoped that results will give some lead on a suitable purification procedure.

Several hundred varieties and near commercial seedlings have been tested to date in observational, ratoon stunting disease resistance trials. The majority of canes have been found to be less susceptible than Q.28, and not a single one more susceptible ; it is unlikely that any cane could not be grown because of the disease, provided adequate precautions are taken. In future, therefore, it is planned to reduce the number of advanced seedlings in these trials, and to increase the number of canes of breeding interest. Many breeding canes have already been tested but, although there is as yet no indication that some lines may confer resistance to the disease, the importance of the subject makes an exhaustive enquiry desirable.

Fig. 68—Collecting chlorotic streak diseased cane for experimental work.

Fiji Disease

Fiji disease was recorded only in the one mill area during the year under review despite systematic inspections of blocks of susceptible varieties in all localities where the disease has been seen in recent years. The affected area is that of Rocky Point, which is situated on the foreshores of Moreton Bay between Brisbane and the Queensland-New South Wales border. Seven fields yielding a total of 42 diseased stools were found affected, each on a separate farm, and the total area involved was a little over ten acres. Thirty diseased stools were rogued from one very small planting, but the majority of infected fields had only one diseased stool. Infected crops were second ratoons or older and they are to be ploughed out after harvest.

The ratoon Fiji disease resistance trial at the Pathology Farm included a range of local advanced seedlings and imported canes. There was a satisfactory development of disease and, although seasonal conditions do play a large part in the transmission of the disease, it is felt that the method of harvesting the plant crop did have a beneficial effect. The pairs of seedling rows were cut and were well advanced in the ratoons before the guard rows were harvested so that the vector *Perkinsiella saccharicida* Kirk) was provided with a continuous shelter of well-developed tops. The results with the important Mauritius canes, M.134/32 and M.63/39, justify the apprehension which pathologists on that island feel concerning the havoc which would be wrought should the disease manage to get across from Madagascar. M.134/32 developed disease in 61 per cent. of the stools and M.63/39 in 31 per cent.; figures for the susceptible standards, H.32-8560, P.O.J.2878, and M.1900S., were 57, 62, and 33 per cent. respectively, and it is obvious that M.134/32, at least, could not be grown commercially in Queensland in the presence of the disease. C.P.49/50, one of the newer importations from Canal Point, gave the same order of resistance as C.P.29/116, a variety with a satisfactory degree of commercial resistance.

Chlorotic Streak Disease

The finding of chlorotic streak disease in three districts in which it had never been reported before has added a sense of urgency to the planned programme of research into the disease, and fully justifies the decision to make research into it a major project of the pathologist stationed in Brisbane and of the assistant pathologist at the Northern Sugar Experiment Station in North Queensland. The finding at Bundaberg consisted of only one

Fig. 69—A drum experiment in a Brisbane glasshouse. This is part of the investigation into the cause and mode of spread of chlorotic streak disease.

stool in rather poorly-drained soil at Fairymead; surveys of neighbouring fields and in similar situations elsewhere in the district did not reveal any further disease. In the Isis area, three fields were found infected and a quarantine has been arranged to prevent the transfer of plants from the diseased farms. Neither at Bundaberg nor Isis was there any evidence of introductions of plants from diseased localities, which could be blamed as possible sources of infection; but in the Giru area, where the disease was also found for the first time, illicit introductions of plants had been made some years ago from areas where chlorotic streak is endemic. The Giru infection occurred on three adjoining farms in a badly-drained locality which had been flooded during the wet season earlier in the year. The Giru area is a small isolated group of mostly irrigated farms between the important cane district of the Lower Burdekin and Townsville. It yields approximately 80,000 tons of cane each season.

Further transmission studies on chlorotic streak disease have been initiated, but to date there are no results to report.

Leaf-scald Disease (Bacterium albilineans) Ashby

Leaf-scald disease is largely confined to the wetter areas in North Queensland and presents a particular problem there, since many of the varieties which show promise for these localities in their good cover and resistance to lodging, have been found to be susceptible to the disease. In collaboration with the plant breeders, a study has been made of the breeding of all canes which have been incorporated in trials, and of which the disease reaction is otherwise known, with a view to concentrating on lines which have given resistant canes. Unfortunately, the parental analysis of the 140 canes involved showed that P.O.J.2878 and Co.290 were the only parents which might be expected to produce resistant canes; the type of cane produced by these varieties is obviously unsuited to the wet, tropical, high production areas. A scheme to progeny test a large number of parents for scald resistance is to be implemented.

The leaf-scald resistance trial concluded in June, 1956, makes the third successive trial at the Pathology Farm in which the inoculation of the stubble with a suspension of the causal agent, as the cane was being cut, resulted in the development of a satisfactory amount of disease, after the sett inoculation in the plant crop had produced a negligible amount of disease. In future trials, the ratoon inoculation technique only will be used.

Results from the 1954-56 trial are set out below; it is obvious that lack of disease in the standard canes, H.Q.426 and Oramboo, would have precluded any conclusions being drawn in the plant crop; much more confidence can be placed in the figures for the ratoons. Canes in the series I.426 to M.736 are advanced Bureau seedlings, which show a wide range of resistance. The resistance of C.P.44/101 and N.Co.293 is to be noted.

Variety	Plant. Diseased/ Total	Ratoons. Diseased/ Total
C.P. 44/101	0/38	0/25
H.Q.426	2/9	19/19
I.426	0/8	9/25
J.225	1/11	18/27
J.330	1/37	10/25
K.616	4/21	23/25
K.628	1/9	7/24
K.648	8/24	18/26
K.675	1/29	15/26
K.690	0/36	5/25
K.696	5/26	17/24
K.717	0/32	1/25
K.M.53	0/27	0/24
M.736	0/14	8/26
N.Co.293	0/3	0/24
Oramboo	1/20	21/27
Q.44	10/20	19/25
Q.50	0/19	0/23
Q.57	0/7	5/25
Trojan	4/40	12/26

* In many instances sett inoculation has had a depressing effect on germination.

Downy Mildew Disease (Sclerospora sacchari) Miy.

The eradication of harmful disease, not just a reduction, is the goal of Bureau disease control measures and, even though it is not often stated in so many words, it is implicit in all the legislative machinery and all Bureau pathology activities. The concept is not widespread, even among sugar-cane pathologists,

Fig. 70—The Mulgrave hot-water treatment tank being used for curing chlorotic streak disease. The cane is being treated in full stalk lengths.

and in many cane countries there is still a policy of live and let live towards disease. As a pioneer, therefore, the Bureau feels that it must be prepared for occasional, inexplicable reverses such as that which occurred in the Bundaberg district in late April, 1956. On the 19th of that month an outbreak of downy mildew was discovered on a farm in the South Kalkie locality. Intensive inspections showed that the disease was confined to the one farm and a total of 130 stools were rogued from six blocks during the course of the next few days. Subsequent inspections, after the most heavily infected blocks had been ploughed out, yielded only six stools—all in blocks which had already shown the disease. All diseased blocks will be harvested early and ratooned before there is

any possibility of secondary infection. This early ratooning will be linked with row-by-row inspections at frequent intervals during the growth of the crop.

The origin of the outbreak is not known and, prior to this outbreak, the disease had never been found on this farm. The last known diseased stool in the cane fields of the Bundaberg district had been rogued two miles away and almost exactly six years before. It is puzzling as to how the disease spanned both time and space in such a manner, but, when considering the problem, it may be apposite to bear in mind the note of caution sounded in the Bureau Annual Report for 1951 (p. 45) following the announcement that for the first time since detailed records had been kept not a single stool infected with downy mildew had been recorded anywhere in the cane fields of the State. The Report went on: "With a bulky crop such as sugar cane grown over extensive areas it would be rash to suppose that the disease has been eradicated, but the results of inspections during the next few years will give a definite conclusion."

This new outbreak will lead to some modification in the downy mildew disease resistance trials which are conducted at the Pathology Farm. During the past few years, only canes which have reached commercial status have been tested, but in future the former policy of testing all advanced seedlings under trial will be reverted to.

Cyclone Damage

The damage to the cane crops in North Queensland by the hurricane winds of the cyclone early in March indicated that the Pathology Section would have an interesting array of facultative parasites to deal with as the decapitated Pindar stalks aged, and as fungi invaded the numerous breaks in the surface of the twisted, lodged stalks and lacerated leaves. The Pindar stalks, however, shot rapidly at the top buds and there was no fungal invasion of the stalk tissue. The snapping had occurred at the growth ring and the fact that only nodal tissue was exposed, and that in a clean break, may have been responsible for the lack of deterioration. The damaged leaves showed nothing of pathological interest and were soon replaced by normal healthy leaves. Stalks of many varieties blown about by the wind were damaged to a varying degree, but generally there was little actual invasion of the tissue when the top remained alive. Breaking of the stalks leading to their death

Fig. 71—Sclerophthora disease in Q.50 at Hamilton Plains, Proserpine, July, 1956.

gave the usual picture of infection by *Pleocyta sacchari,* the causal agent of rind disease, and there were some reports of suspected rind disease in living cane. Investigation of these reports showed that the loss of leaf cover and the lodging had exposed the stalks, while still immature, to the direct rays of the summer sun, the effect of which was made still more severe by the lack of cloud cover during the fortnight following the cyclone. The sand-blasting effect of the high, dry winds was also marked on the stripped stalks. Injury to the rind by either sun and/or abrasion showed as a scalding and subsequent cankering, and at first sight the symptoms resembled those due to rind disease. Sectioning of the stalks showed that there had been little damage to the underlying stalk tissue. Isolations made from the cankers showed only known saprophytes and a fungus resembling *Acremonium,* the pathogenicity of which to sugar cane is unknown.

Miscellaneous

Investigation of an outbreak of *Sclerophthora* disease in the Proserpine district revealed the heaviest infection ever seen in Queensland on a farm scale. Up to 60 per cent. of the stools were affected in parts of some blocks, and the disease was concentrated particularly along the edges of the cane beds against the shallow drains. The area is not well drained and in the severe wet of 1956 was under water for long periods. An idea of the conditions prevailing is given by the rainfall recorded at Proserpine for the first six

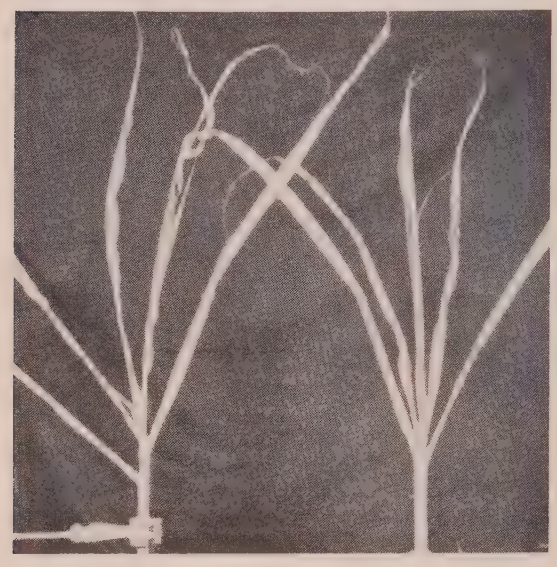


Fig. 72—Twisted leaves from a "poor growth" patch, Lower Burdekin, June, 1956.

months of the year, which, of course, includes the summer wet season. Over 117 inches fell during that period in 1956, compared with 53 inches for the average since records were first taken. There was some evidence that commercial canes varied in resistance, and small plantings of all available commercial canes and advanced seedlings have been arranged for the coming spring in a field subject to the disease. Oospores of *Sclerophthora* sp. were found in and near the affected cane fields in Para grass (*Brachiaria mutica*) and in another grass resembling *Axonopus compressus*, but which could not be positively identified owing to lack of flowers.

The ratoon failures occurring in small patches in fields in the Bundaberg district have been the subject of intensive investigation, and a large number of exploratory trials have been laid down. Lines of attack on the problem include soil conditioning, sterilising, and fumigation, and treatment of the growing plant or young stubble with fertilizers, fungicides, and plant stimulants. At the moment the only significant observation appears to be that the stools on the headland always ratoon normally, but responses in the current trials may also yield important clues.

Two germination trials were planted in the winter of 1955, both on farms in the Lower Burdekin area. The range of organo-mercurial formulations tested did not reveal any to be superior to the standard commercial preparations marketed as "Aretan," "Baytan," or "Clerit." An interesting and unexpected feature of the trials was the absence of the pineapple disease organism from the untreated controls. Lower Burdekin farms have suffered severely from this disease in the past and the losses sustained were directly responsible for the almost general adoption of mercurial preplanting sett treatment in that district some years before the practice was adopted in other parts of the Queensland sugar-cane belt. It is not felt that there is any particular significance to be attached to the absence of the disease in these trials and the abandoning of mercurial treatment would certainly not be justified.

Improvements effected on the Pathology Farm at Eight Mile Plains during the year included a nine-chain front fence of chain wire and sawn timber, a steel and galvanised iron prefabricated shed to house the pump and motor, both of which were remounted on concrete blocks, and the extension of the two-inch irrigation main to service the southern third of the main cultivation area. The swamp-hole from which the irrigation water is drawn was cleared by means of a sludge pump, and plans were prepared for the transfer of the laboratory mill from the Department of Agriculture and Stock building in the city to the Farm. Routine resistance trials conducted at the

Farm included those for Fiji, red rot, ratoon stunting and leaf-scald diseases; investigational plantings were largely confined to those made in connection with ratoon stunting disease research.

Visitors to the Pathology Farm included pathologists and other scientists from several overseas sugar countries. Dr. S. J. P. Chilton, Head of the Department of Botany, Bacteriology and Plant Pathology, Louisiana State University, called in for discussions on plant pathology and cane breeding on his way to the I.S.S.C.T. Congress in India. Mr. K. S. Chan, of the Department of Agriculture, Jesselton, North Borneo, an entomologist by training, has interests in both the pests and diseases of a wide range of tropical crops; he was here as a Senior Fellow under the Colombo Plan. Several Indian agriculturists visiting Australia under the Plan, and some here independently, also were interested visitors to the Farm.

Mr. C. G. Hughes returned from an extensive tour of Europe and Northern American plant pathology research centres in October, 1955. He has prepared a lengthy, illustrated report, but in view of its specialised nature it has been circulated only among Bureau officers, although some items from it have been featured in "The Cane Growers' Quarterly Bulletin."

Quarantine House

Varieties planted in the quarantine house in the spring of 1955 included canes from the mainland United States of America, Hawaii, Mauritius, South Africa and India. At the same time, the variety Sumatra No. 1 was ratooned for further observation since, in the plant crop, it had shown an unexplained leaf scorching. When this was seen to continue into the ratoons, the stools were destroyed. No fungus was found associated with the leaf damage. Some of the Indian canes developed mosaic-like markings very similar to markings which had appeared in the house on a previous occasion and which were also intercepted in the sugar-cane quarantine house of the United States Department of Agriculture at Beltsville, Maryland, and shown to Mr. C. G. Hughes on his visit there last year. The affected stools in the Brisbane house were destroyed and the decision made that no canes from India will be released onto the Experiment Stations until they have been held in open quarantine, away from commercial cane, for at least a year after passing through the house.

Soil applications of "Systox" to the pots in the quarantine house have continued to give a satisfactory control of aphids, mites, and mealy bugs.

Division of Mill Technology

J. H. Nicklin, Chief Technologist (Engr.)
and
L. R. Brain, Senior Mill Technologist

Staff

While the actual numerical strength of the Division has remained unchanged, the two Assistant Mill Technologists, Messrs. R. Deicke and J. D. Harland, have joined the active service of the Division and are now stationed in Bundaberg. During 1955 these two officers were in full time attendance at the University where they completed the requirements of the Post Graduate Course in Sugar Technology.

Laboratory Investigations

Facilities for certifying apparatus for mill laboratories have been availed of by the mills, the usual volume of equipment passing through the laboratory in Brisbane. In all, the following equipment was certified—244 brix spindles, 80 flasks, 16 pipettes, 1 burette, 33 thermometers, 50 polariscope tubes, and two sets of weights. In addition, one hand refractometer was checked for accuracy and four polariscopes were overhauled and certified for accuracy.

The operation of a mechanical convection oven was examined for constant temperature at various points in the unit and the characteristics of the oven were determined.

Two samples of Horne's dry lead were submitted by commercial firms; one was rejected while the other was acceptable for mill use.

Crystallizer Studies

As an extension of the work initiated during the 1954 season, a series of tests was conducted on the Blanchard crystallizers which had been recently installed at Millaquin. The previous tests at Mossman had been unsatisfactory due to a varying rate of water flow to the crystallizers and to the fact that the massecuites usually contained a considerable amount of fine grain. The tests at Millaquin were not troubled by these influences.

The heat transfer coefficients were determined at two rates of water flow, sufficiently far apart to indicate whether this factor would influence heat transfer. The coefficients found were 4.6 Btu./sq. ft./°F./hr. at a water flow of 4100 lb. per hour and 4.9 Btu/sq. ft./°F/hr. at 7000 lb. per hour indicating that the massecuite side of the cooling surface exerted the greatest influence on the transfer of heat. These values are considerably above those recorded at Mossman, due to the high final temperature (about 120° F.) to which the massecuite was cooled at Millaquin. It is fairly certain that lower figures would have been obtained, if the massecuite had been cooled to more reasonable temperatures. This could only be achieved by increasing the capacity of the crystallizer station.

Although crystallization proceeded for only 9 hours, the purities of cured molasses recorded were excellent. It is true that a crystallizer can never fully recover the bad work of a pan and the results showed how essential good pan work is for the achievement of overall results. The tests also indicated the importance of the temperature to which the massecuite is cooled. Even though excellent work was recorded for these crystallizers, it is evident that further cooling would produce worthwhile improvements.

It appears that the Blanchard crystallizer is an efficient unit and it now remains to be seen how the heating surfaces stand up to the ravages of corrosion, especially on the water side. The cooling water and heating water are both treated to inhibit corrosion and a periodic check will be made on the heat transfer characteristics of these crystallizers.

Pilot Plant for Wax Extraction

Following the conversion of the pilot plant to operate with mud slurry, some preliminary laboratory tests were conducted to determine a suitable technique for the operation of the plant. These tests established that—

(a) It is very difficult to work with a mud slurry on a small scale; the mud particles block up small openings.

(b) A slurry of 88 per cent. water was necessary for the best operation of an extractor.

(c) The degree of agitation was important. Too severe agitation caused the formation of an emulsion of solvent and water which was difficult to break. However, good contact between the mud and solvent was essential.

(d) With small tubes, a maximum solvent velocity existed above which mud was carried over. This effect was not apparent with large tubes.

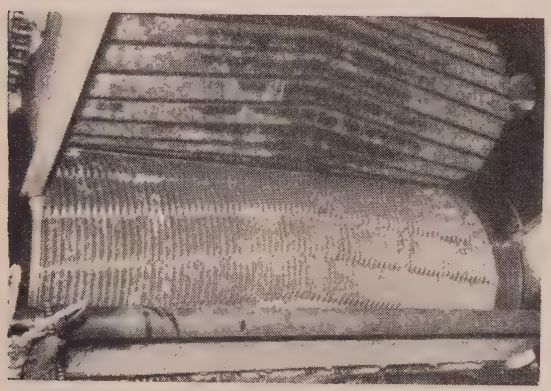


Fig. 73—Feeder Roller, Fairymead Mill.

The initial trials with the pilot plant were most unsatisfactory, extractions of only 14 per cent. being recorded in two hours. The results indicated that either the sampling technique was faulty or the degree of agitation was insufficient. The plant has now been fitted with a new driving device for increasing the agitation, and tests will be continued in the early part of the 1956 season.

Molasses-Bagasse Stockfeeds

The feeding trial which was initiated during last year was brought to a conclusion during the latter part of 1955, some fifteen tons of molasses-bagasse mixture being supplied to the Animal Research Institute by the Bundaberg staff. The bagasse was dried by a variety of methods, mostly in bags on boiler flues and subsiders. After drying to approximately 12 to 15 per cent. moisture, the bagasse was screened through ½ inch mesh screens and the molasses and bagasse were mixed in the ratio of 70 parts of molasses to 30 parts of bagasse. The preparation of the feed was performed by Protein Stockfoods Pty. Ltd. of Bundaberg.

The results of the first feeding trial conducted by the Animal Research Institute showed that the mixture could be used successfully in feeding ruminant animals. An average increase in weight of 2.1 lb. per day was recorded, which gain compared favourably with the gains in tests conducted in the U.S.A. with the best quality feeds. The economic side of the test was not encouraging, but it must be remembered that expensive additives such as linseed meal and lucerne chaff were used with the feeds. Further trials would include meat meal as the source of protein and bagasse would form the sole roughage in the feed.

A minor trial along these lines indicated that animals would eat the mixture with meat meal additions, although some animals were initially reluctant to take the feed. Also the animals could consume molasses at the level of 50 per cent. feed without any ill-effects. A more extensive trial is planned along the lines of this test to commence early in 1957.

As far as the Bureau is concerned, the drying and screening of the bagasse involves considerable time and labour and an offer was made by the Fairymead Sugar Company to co-operate with the Bureau in producing the feed. Consequently, the Bureau staff has drawn up plans for a small plant to dry and screen bagasse and mix the molasses-bagasse feed. This plant will be erected by Fairymead and should be producing stockfeeds for trial purposes before the end of 1956.

Lytron X-886 Trials

Considerable comment has been made in overseas literature on the use of Lytron X-886,

a polyelectrolyte, as an aid in the clarification process. Preliminary laboratory trials with this material in Bundaberg did not show any positive advantages from its use; but, as it was claimed that a factory trial was essential to determine the effectiveness of the material, a trial was conducted at Millaquin.

The range of the addition of Lytron varied between 3 and 8 p.p.m. and the results did show some benefit. Increasing quantities of Lytron did result in a reduction of the suspended matter in clarified juice and a higher density of mud. An upper limit of 8 p.p.m. was indicated by the tests. However, the figures obtained during the weeks when Lytron X-886 was in use did not show outstanding differences from those when no Lytron X-886 was added and no effect was observed in the operation of the subsiders and the filters.

Fig. 74—New Feeder Carrier at Fairymead.

Throughout the tests, purity relationships, the filterability of the sugars, the scaling of the effets, and the boiling of the material were closely watched, and no alteration in characteristics due to the addition of Lytron X-886 was observed. Admittedly, the clarification at the time was excellent and any improvement in this direction would have been very difficult. At least under the conditions at Millaquin, the tests proved that the use of Lytron X-886 was not warranted.

The Use of Soda Ash in Clarification

Hawaiian factories have used considerable quantities of soda ash over the past years, replacing some of the lime used in the clarification of juice. The main advantage of the use of soda ash has been the reduction in the quantity of scale in the effets and the subsequent ease of removal. Some factories have been able to crush for five to nine weeks without cleaning the heating surfaces of the effets. Moreover, where stale cane is being handled, improved boiling characteristics are claimed.

The procedure of the tests, which were conducted at Qunaba, was to add soda ash at the initial rate of 20 per cent. on normal lime usage on the first and third weeks of the trial, normal liming being practised on the intermediate week, and to compare the weekly results. Actually, on the first week soda ash was added at the rate of 11.6 per cent. on lime and 20.9 per cent. on the third week.

The quantity of lime used was of the order of 0.06 per cent. on cane and, even when soda ash was added, this quantity did not vary to any extent. This occurrence was contrary to all expectations and no reasonable explanation can be offered other than, perhaps, that the method of determining the lime usage was not sufficiently accurate.

The tests did suggest that the use of soda ash would decrease the calcium content of the juice, but the magnesium content was unaltered. Factory work was unaffected by the soda ash and, in particular, the ash of the shipment sugars remained very constant.

Some evidence of a beneficial effect was found in the scaling of the effets. Although the quantity of scale deposited was approximately constant, the scale was more readily removed when the soda ash was in use.

Further tests are contemplated during which the effect of higher dosages of soda ash, up to 30 per cent. on the lime requirements, will be ascertained.

Investigations at Mossman Mill

At the request of the management of Mossman mill, an extensive investigation of this

mill was undertaken, mainly to determine the reasons for the unusually high undetermined loss recorded during the early part of last season. Detailed reports on the operations of the various stations were prepared and recommendations for instrumentation and process procedure were given. The Bureau was in close touch with the management of this mill throughout the whole season and a marked improvement was experienced during the latter part of the period.

Boiler Investigations

The general change toward higher fibred cane varieties has reduced the urgent need for steam economy and higher boiler efficiency. Very little extraneous fuel is burnt to-day and most of that is used for the "start-up" at the beginning of the week or for "finishing-off." One investigation was carried out, however, on the combustion efficiency at a northern factory and general matters relating to boiler plant were discussed with several other factories.

Generally speaking, the installation of economisers and/or air heaters is not warranted under present conditions, but it is hoped that, in the not too distant future, surplus bagasse will be sought for by-product use, and will then have a definite value, instead of being the liability which it is to-day. It would therefore be advisable for any factory which is planning boiler extensions to make provision for the possible future installation of an air heater or economiser; an efficiency higher than sixty per cent. would be almost impossible to obtain without one of these units.

Factories which are situated in, or close to, towns are now becoming more interested in eliminating the nuisance caused by unburnt carbon particles issuing from the smokestack. There is no doubt, of course, that by spending sufficient money this nuisance can be completely eliminated, but such complete elimination could be very costly. The Bureau is investigating the matter and in the near future hopes to be able to make recommendations for an eliminator of reasonable efficiency which could also be installed at a reasonable cost. In the meantime, it would be advisable for all factories which are planning boiler alterations or the erection of a new stack, to allow sufficient space for the installation of a fly ash catcher—in addition to an air heater or economiser.

Electrical

Electrical expansion during the post-war years has kept pace with the general expansion in the industry. Factories are now tending to more or less stabilise the crushing rate, which averaged about 100 tons per hour for the 1955 season, and most expansion programmes have been completed.

Plant records show that a total of 27 turbo-alternator sets are now used in the Queensland industry and only six of the factories with which the Bureau keeps in close contact do not use this compact form of generating unit. These six factories are fairly well equipped with engine-driven sets and it would therefore appear that, unless some by-product industry is established, there will be little demand for heavy electrical plant for some years.

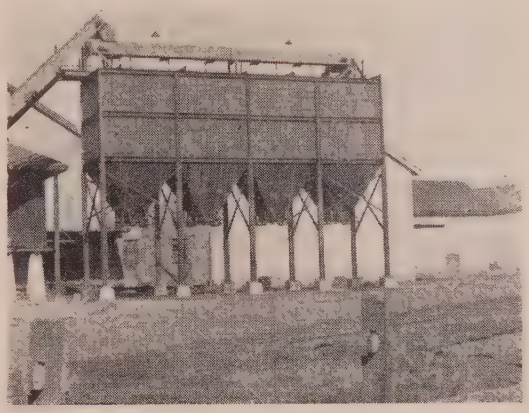


Fig. 75—Mud Disposal Unit at Millaquin.

Bagasse as a By-product

The production of alcohol from molasses is well established in Queensland and mention has already been made of the work being done by the Bureau regarding the use of a molasses-bagasse mixture for stock feeding

and the recovery of cane wax from filter mud. There are many other by-product possibilities, but those which aim at the utilisation of the large quantity of surplus bagasse which is available (and much more could be produced if there were any incentive to do so) are of particular interest to the sugar industry.

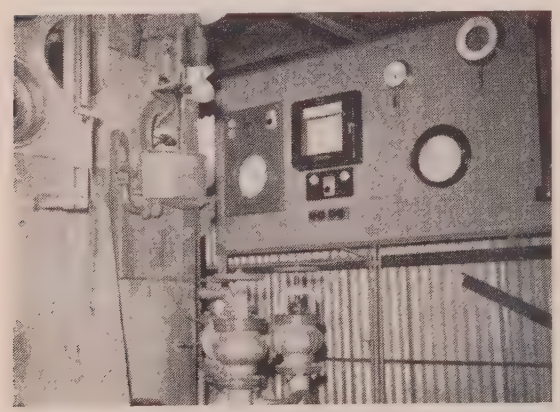


Fig. 76—Webre Pan with Control Panel at Tully.

One interesting scheme for using the 100,000 tons or more of surplus bagasse which is available in an average year from the Mackay district mills has been put forward by the Manager of the Mackay Electric Authority. The scheme allows for the installation at each mill of a condensing turbo-alternator set plus auxiliaries, and additional boiler and bagasse storage equipment. The plant would operate continuously, including week-ends, during the crushing season and would feed steady power into the Electric Authority's transmission system. For slack season power the scheme proposes the development of one or two small hydro-electric sites in the mountains west of Mackay. These hydro-electric stations would be able to give an output about equal to that from the mills and would operate during the slack, which is also the wet season. The mills would take over supply during the crushing when there would be little water power available. In drought years it would probably be necessary to use coal or oil in the mill boilers for a month or two.

The proposer of the scheme argues, and with good reason, that the mills should not make any charge for surplus bagasse as at present they are paying a considerable sum annually to get rid of it, therefore fuel costs would be practically nil. The capital cost of the scheme would be high but, if it were not implemented, an amount of the same order would have to be spent on the further development of the existing Mackay power station or the building of an additional station at another site.

The Bureau would have no hesitation in strongly supporting the "Mackay scheme" if it considered that surplus bagasse would continue to be of no value. It feels, however, that this will not always be the case and that at some future date bagasse will have a definite value when used as a raw material to produce a much more valuable commodity.

The manufacture of paper from bagasse is now past the experimental stage. There are no technical problems to be solved and at least

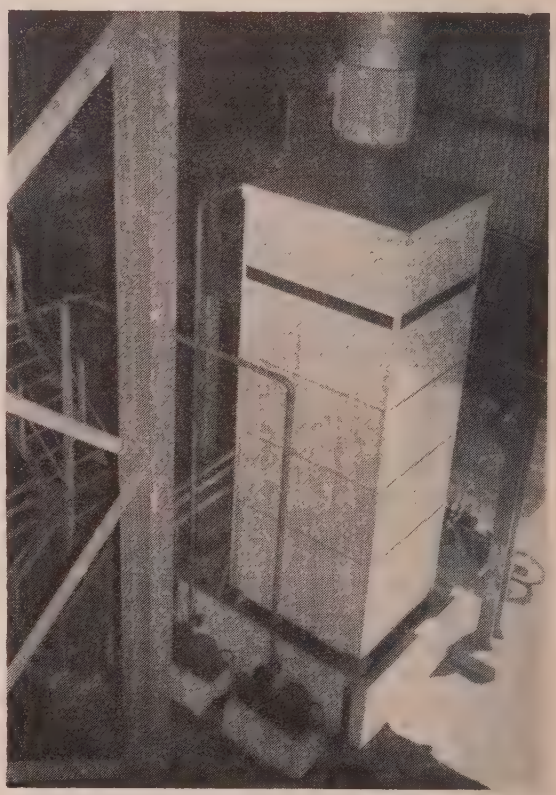


Fig. 77—Water Cooler for Crystallizers at Millaquin.

five plants in different parts of the world are turning out a high quality product. An alternative product would be hardboard.

The economic possibilities of a bagasse paper factory in Queensland appear most encouraging. A preliminary investigation has been made of a hypothetical factory with a capacity of 11,000 tons of high-quality paper per year. In this particular case the bagasse (51,000 tons) was not all surplus, replacement fuel had to be allowed for and this took the cost of the bagasse to £187,600. In spite of this high cost for the main raw material the proposition showed an excellent return on a capital expenditure of £3,000,000.

General

Each mill in the State was visited at least once during the crushing season and problems were discussed with the staff. In some cases, detailed reports on specific stations were prepared when requested.

THE 1955 SEASON

After the record year of 1954, a substantial drop was experienced by the industry in both cane crushed and sugar produced. Warnings of the possibility of overproduction had been sounded at the termination of the 1954 season, but this did not eventuate due to a number of factors. The amount of cane crushed was 8,616,163 tons and the drop was due to the early and extensive arrowing which occurred and to an undisclosed amount of wind damage. Also the extension of the wet season into the winter months and the consequent lack of sunshine inhibited the normal rise in the sugar content of the cane in the northern areas and the total production of 94 n.t. sugar was 1,135,331 tons, a figure which did not exceed the aggregate of the mill peaks. An indeterminate factor in the sugar production was the effect of the industrial trouble towards the end of the year whereby the season was extended at many mills.

The overall effect of the quality of cane and the internal efficiency of the mills themselves resulted in a figure of 7.59 tons of cane per ton of sugar produced compared with a figure of 7.58 for the 1954 season. The c.c.s. of cane showed a slight rise from 13.50 to 13.53 indicating that a noticeable decline in factory efficiency was experienced.

A disturbing feature of the cane supply over the past few years is the rapidly increasing quantity of extraneous matter which is being brought to the factories along with the cane. Wind damage certainly aggravates the situation but the standard of the cane in areas unaffected by wind is also deteriorating. It is difficult to determine the effect of the extraneous matter, trash, stones, and soil, on mill efficiency figures; but the adverse effect on milling equipment was very noticeable in polished rollers and damage to other equipment such as knives.

The total number of days required to handle the crop was 5,397, a comparatively short season which would have been even shorter without industrial trouble. As shown by the analysis of gross time, the premeditated stops showed a rise of over 3 per cent., which could be principally attributable to the forementioned industrial trouble. The cane supply was apparently quite good, as the lost time was reduced from 4.20 per cent. in 1954 to 2.31 per cent. in 1955, while the lost time due to manufacturing troubles rose from 3.12 per cent. to 4.14 per cent.

With the installation of new equipment in the mills, the average crushing rate is steadily rising, an increasing number of mills now exceeding the one-time goal of 100 tons of cane per hour. The increases are all the more commendable when it is realised that the fibre in cane is now rapidly mounting with the introduction of new varieties. The pol extraction shows a decline from 94.85 to 94.71 when compared with that of last season, the northern and central districts showing decreases in extraction while the southern district shows an increase. The increased crushing rate combined

with the increased fibre in cane has apparently made the task of milling more difficult in the former areas.

During last season, milling practice moved further towards the pressure-fed mill, quite a number of these units being installed. The apron type feeder with a feeder roller also shows promise of becoming more common.

The decreased efficiency of the mills is reflected both in the recovery, which fell from 85.62 to 84.89, and the coefficient of work, which declined from 97.47 to 96.88. It can readily be seen that the declining efficiency is of considerable concern but no one factor can be held responsible. The determined losses of pol in bagasse, molasses, and filter mud all increased, doubtless due to the effect of the increased rate of throughput. The purity of final molasses also has risen by 0.14 units although the expected purity has increased by approximately the same amount. In the light of this comparison, the low grade stations of the mills have at least held their ground with the increased rate—a very pleasing feature of the season.

Undetermined losses have also shown an increase from 2.2 to 2.38, but the empirical nature of the determination of our basic material, pol in cane, will always cast doubts on the accuracy of this figure. The figure is highest in the northern area at 3.47 and it decreases to 2.16 and 1.90 in the central and southern districts respectively. A similar trend was evident in figures for the 1954 season and an increase was experienced in each district in 1955.

With the rapid approach of the bulk handling of raw sugar, the quality of the raw sugar produced is of interest and it is disturbing to note that the average quality has dropped markedly. Both the pol and net titre of the sugar have fallen, the former to 98.75 and the latter to 97.33. The dilution indicator of the sugar has risen from 30 to 36, a figure which approaches the safe limit of 40. In many cases, the inadequacy of drying equipment is becoming more acute with increasing throughput of sugar.

The dilution indicator of the sugar produced in the northern area was 41 which was partly due, no doubt, to the unsuitable atmospheric conditions in this area. The absolute necessity for dryers of adequate capacity, equipped with heaters for conditioning the air to handle the peak loads cannot be too strongly stressed.

The total fuel used and the added fuel have increased for the 1955 season. Lost time due to mechanical troubles would account for the increase in the added fuel while the increase in the bagasse used is due to the increase in fibre per cent. cane. This figure is quite misleading as a measure of boiler efficiency, however, as the main problem in many mills is the disposal of the bagasse, not its efficient burning.

Broadly, the 1955 season did not present such a bright picture as the previous season did. Losses in all departments increased, but the increased rate of crushing could be largely held responsible for this state of affairs, the crushing rate now exceeding the processing capacity of the factories. With further increases in crushing rates, extensions to equipment will probably become necessary to maintain reasonable standards of efficiency.

Table X Production Data for Queensland Mills for Seasons 1949-1955 (Totals and Weighted Averages)

Northern District	1949	1950	1951	1952	1953	1954	1955
Cane—							
Tons	2,426,929	2,622,402	2,135,564	3,092,819	3,315,716	3,943,427	3,270,354
Pol per cent.	15·50	14·40	15·64	14·84	15·45	13·88	13·55
Fibre per cent.	10·58	10·35	11·26	11·24	11·61	10·93	11·38
C.C.S.	14·36	13·21	14·58	13·70	14·48	12·70	12·36
Purity 1st expressed juice	89·17	87·81	90·08	88·47	89·96	87·20	86·96
Sugar—							
Tons 94 net titre	345,684	344,944	304,786	421,921	467,716	502,276	413,853
Cane per ton sugar	7·02	7·60	7·01	7·40	7·09	7·85	7·90
Pol per cent.	98·42	98·47	98·52	98·66	98·81	98·50	98·60
Net titre	96·99	97·12	97·07	97·33	97·52	97·09	97·33
Dilution indicator	30·0	29·0	28·8	31·3	31·0	30·5	41·0
Pol per cent. pol cane	84·59	85·29	85·39	86·61	85·78	85·17	84·67
Mud—							
Tons	42,450	46,765	38,342	53,197	55,582	63,816	54,285
Mud per cent. cane	3·12	3·10	3·13	2·91	2·95	2·96	3·07
Pol per cent.	3·59	3·66	4·10	4·50	3·55	2·96	3·47
Pol per cent. pol cane	0·72	0·79	0·82	0·90	0·69	0·64	0·79
Molasses—							
Gallons (1000's)	6,143	6,737	4,950	7,905	7,723	10,246	8,243
Gallons per ton cane	4·51	4·48	4·04	4·32	4·17	4·76	4·66
Brix	86·57	86·36	88·82	88·28	89·87	89·78	91·38
Apparent purity	34·15	30·93	33·78	31·66	33·97	32·49	31·87
True purity	47·78	44·73	45·57	43·36	45·71	44·31	44·40
Expected purity	—	—	38·36	37·99	38·90	38·0	38·4
Reducing sugars/ash	—	—	—	—	—	—	1·90
Pol. per cent. pol cane	5·68	5·36	4·86	5·90	5·62	6·74	6·79
Final Bagasse—							
Tons	308,622	335,620	295,620	429,961	446,918	489,784	421,275
Bagasse per cent. cane	22·68	22·26	24·14	23·48	24·24	22·74	23·83
Pol per cent.	3·12	3·04	3·09	2·97	3·03	2·63	2·55
Dry substance	50·70	50·49	51·33	52·30	51·63	51·55	51·39
Pol per cent. pol cane	4·75	4·70	4·77	4·64	4·73	4·31	4·48
Undetermined loss—							
Pol per cent. pol cane	4·26	3·86	4·16	1·95	3·18	3·14	3·47
Fuels—							
Tons: Wood	5,702	8,768	3,847	5,175	5,181	3,498	4,909
Coal	—	—	—	—	—	40	42
Molasses	8,436	16,691	6,577	5,951	1,206	6,982	9,093

Central District	1949	1950	1951	1952	1953	1954	1955
Cane—							
Tons	2,691,364	2,580,013	1,971,468	2,685,687	3,773,830	4,119,775	3,641,996
Pol per cent.	15·41	14·96	16·44	15·95	16·02	15·27	15·56
Fibre per cent.	12·10	12·68	13·35	12·56	12·85	13·36	13·93
C.S.S.	14·11	13·93	15·28	14·80	14·92	14·18	14·39
Purity first expressed juice	87·59	89·60	89·66	89·56	88·82	89·43	88·82
Sugar—							
Tons 94 net titre	375,654	355,751	286,416	388,343	547,648	570,867	509,146
Cane per ton sugar	7·16	7·25	6·88	7·02	6·89	7·22	7·15
Pol per cent.	98·96	98·74	98·52	98·82	98·96	98·91	98·78
Net titre	97·91	97·25	96·81	97·37	97·71	97·58	97·36
Dilution indicator	33·0	29·0	28·2	30·0	29·5	27·7	34·6
Pol per cent. pol cane	86·27	86·73	84·12	86·46	86·24	86·46	85·68
Mud—							
Tons	86,934	81,414	64,799	81,139	133,893	145,162	128,115
Mud per cent. cane	3·23	3·15	3·49	3·33	3·49	3·52	3·52
Pol per cent.	2·67	2·67	3·36	3·21	2·95	2·59	2·54
Pol per cent. pol cane	0·56	0·55	0·71	0·57	0·66	0·60	0·57
Molasses—							
Gallons (1,000's)	15,378	10,681	9,649	12,573	18,690	18,227	17,678
Gallons per ton cane	5·72	4·14	4·89	4·68	4·95	4·42	4·85
Brix	88·73	88·57	90·33	90·45	89·75	90·15	90·94
Apparent purity	34·11	36·17	35·35	34·50	34·62	35·65	34·67
True purity	45·40	45·74	45·01	44·01	44·60	44·19	43·46
Expected purity	—	—	40·64	40·80	39·81	40·70	40·30
Reducing sugars/ash	—	—	—	—	—	—	1·33
Pol per cent. pol cane	7·37	5·73	5·96	5·92	6·14	6·00	6·27
Final Bagasse—							
Tons	697,490	668,330	552,250	695,837	1,010,347	1,116,182	1,052,025
Bagasse per cent. cane	25·91	25·89	27·34	25·91	27·01	27·09	28·89
Pol per cent.	2·67	2·37	2·71	2·60	3·07	2·81	2·87
Dry substance	50·99	51·48	51·71	52·40	51·96	52·67	52·01
Pol per cent. pol cane	4·49	4·04	4·60	4·19	5·11	5·03	5·35
Undetermined Loss—							
Pol per cent. pol cane	1·31	2·95	4·61	2·86	1·85	1·91	2·16
Fuels—							
Tons: Wood	8,576	10,140	5,084	3,822	6,985	3,594	4,053
Coal	743	528	225	233	181	81	39
Molasses	98	18	—	—	—	—	—

Southern District	1949	1950	1951	1952	1953	1954	1955
Cane—							
Tons	1,399,749	1,489,291	898,140	1,063,030	1,661,517	1,801,103	1,703,813
Pol per cent.	14·07	13·50	14·07	13·21	13·82	14·08	14·12
Fibre per cent.	14·80	14·96	14·56	14·19	13·52	14·77	14·70
C.C.S.	12·83	12·32	12·69	11·90	12·51	12·91	12·89
Purity first expressed juice	87·10	87·10	85·76	85·40	85·90	87·80	87·22
Sugar—							
Tons 94 net titre	175,929	179,149	113,140	124,350	205,019	228,102	212,676
Cane per ton sugar	7·96	8·31	7·94	8·55	8·10	7·90	8·01
Pol per cent.	98·90	98·80	98·80	98·94	98·90	99·00	98·83
Net titre	97·08	97·33	97·24	97·55	97·51	97·68	97·26
Dilution indicator	33·0	34·0	28·6	31·5	29·6	32·8	35·9
Pol per cent. pol cane	85·34	85·32	85·61	84·62	85·03	85·82	84·58
Mud—							
Tons	42,957	52,451	35,971	37,451	57,018	65,650	61,903
Mud per cent. cane	3·09	3·66	4·02	3·56	3·47	3·70	3·69
Pol per cent.	2·99	2·53	2·42	2·70	2·67	2·73	2·91
Pol per cent. pol cane	0·66	0·69	0·70	0·72	0·67	0·72	0·76
Molasses—							
Gallons (1,000's)	6,826	6,744	4,445	5,232	7,678	7,248	7,708
Gallons per ton cane	4·88	4·53	4·97	4·97	4·67	4·09	4·59
Brix	89·16	90·75	91·27	91·77	91·71	91·57	91·84
Apparent purity	38·48	37·60	33·84	34·44	32·75	36·13	36·10
True purity	46·80	45·57	43·72	43·24	41·74	43·00	44·38
Expected purity	—	—	40·56	41·09	40·40	42·00	42·60
Reducing sugars/ash	—	—	—	—	—	—	0·88
Pol per cent. pol cane	7·85	7·55	6·92	7·98	6·54	6·42	7·34
Final Bagasse—							
Tons	416,113	437,610	275,890	317,961	477,531	567,691	518,682
Bagasse per cent. cane	30·22	30·56	30·85	30·23	29·17	32·00	30·91
Pol per cent.	1·95	1·95	2·19	2·10	2·46	2·41	2·45
Dry substance	52·01	51·40	50·47	49·87	49·46	49·29	50·73
Pol per cent. pol cane	4·20	4·42	4·83	4·75	5·19	5·48	5·35
Undetermined Loss—							
Pol per cent. pol cane	1·95	2·02	1·94	1·93	2·57	1·56	1·90
Fuels—							
Tons: Wood	5,558	3,870	4,306	3,493	4,774	4,595	4,332
Coal	88	351	642	511	519	308	108
Molasses	—	—	—	—	—	—	—

All Queensland Districts	1949	1950	1951	1952	1953	1954	1955
Cane—							
Tons	6,518,042	6,691,706	5,005,172	6,841,536	8,751,063	9,864,305	8,616,163
Pol per cent.	15·09	14·52	15·68	15·07	15·38	14·64	14·72
Fibre per cent.	12·41	12·52	12·90	12·44	12·69	13·02	13·48
C.C.S.	13·85	13·40	14·50	13·90	14·26	13·50	13·53
Purity first expressed juice	87·86	88·43	88·93	88·21	88·45	88·47	87·97
Sugar—							
Tons 94 net titre	897,267	879,844	704,342	934,614	1,220,383	1,301,245	1,135,675
Cane per ton sugar	7·26	7·61	7·11	7·32	7·17	7·58	7·59
Pol per cent.	98·81	98·68	98·58	98·78	98·91	98·83	98·75
Net titre	97·75	97·22	96·97	97·38	97·61	97·47	97·33
Dilution Indicator	31·0	30·0	28·4	30·5	29·9	29·9	36·5
Pol per cent. pol cane	85·62	86·00	84·79	86·21	85·88	86·00	85·20
Mud—							
Tons	171,981	180,630	139,112	171,787	246,493	274,628	244,303
Mud per cent. cane	3·17	3·27	3·36	3·23	3·36	3·41	3·45
Pol per cent.	2·97	2·88	3·32	3·56	3·02	2·71	2·84
Pol per cent. pol cane	0·62	0·65	0·74	0·70	0·67	0·63	0·66
Molasses—							
Gallons (1,000s)	28,356	24,162	19,044	25,710	34,091	35,721	33,629
Gallons per ton cane	5·22	4·33	4·66	4·62	4·69	4·44	4·74
Brix	88·30	88·55	90·20	90·04	90·22	90·34	91·25
Apparent purity	35·17	35·10	34·59	33·61	34·05	34·84	34·31
True purity	46·22	45·36	44·83	43·32	44·20	43·98	43·90
Expected purity	—	—	39·92	39·90	39·70	40·20	40·40
Reducing sugars/ash	—	—	—	—	—	—	1·32
Pol per cent. pol cane	7·05	6·07	5·82	6·25	6·09	6·28	6·63
Final Bagasse—							
Tons	1,422,225	1,441,560	1,123,760	1,443,759	1,934,796	2,173,657	1,991,982
Bagasse per cent. cane	26·20	26·11	27·15	25·93	27·03	27·01	28·10
Pol	2·56	2·40	2·68	2·60	2·91	2·67	2·69
Dry substance	51·25	51·23	51·31	51·82	51·35	51·53	51·54
Pol per cent. pol cane	4·49	4·31	4·69	4·43	5·03	4·94	5·15
Undetermined loss—							
Pol per cent. pol cane	2·22	2·97	3·96	2·41	2·53	2·15	2·38
Fuels—							
Tons: Wood	19,836	22,778	13,237	12,562	16,940	11,687	13,294
Coal	1,150	879	867	744	700	1,152	189
Molasses	8,534	16,709	6,577	5,951	1,206	6,982	9,093

Tons of cane, tons of sugar and tons of cane per ton of sugar include all mills. All other figures exclude C.S.R. and Rocky Point mills, except—From 1950, Fuel figures include Pioneer and Inkerman. Mt. Bauple is exluded from all except tons cane, tons sugar and tons cane per ton of sugar in 1950, and from all figures in following years.

Table XI

Tons of Cane per Ton 94 Net Titre Sugar, 1946-1955

Season	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Tons Cane per ton 94 N.T. Sugar	7·25	7·26	7·07	7·26	7·61	7·11	7·32	7·17	7·58	7·59

Table XII

Figures for 1955 Season (Totals and Arithmetic Averages)

	Northern	Central	Southern	All Districts
Tons Cane Crushed	3,270,354	3,641,996	1,703,813	8,616,163
Tons 94 N.T. Sugar made	413,853	509,146	212,676	1,135,675
Net Titre of Sugar	97·28	97·40	97·12	97·29
Tons Cane per ton 94 N.T. Sugar	7·90	7·15	8·01	7·59
C.C.S. of Cane	12·42	14·40	12·94	13·49
Coefficient of Work	97·17	96·87	96·69	96·88
Coefficient of Work E.S.G.	92·17	92·03	92·08	92·08
Crushing Rate	109·81	101·01	82·02	97·20
Lost Time per cent. Available Time	10·96	8·24	8·53	8·94
Fibre of Cane	11·43	14·01	14·80	13·66
Pol of Cane	13·61	15·57	14·16	14·68
First Expressed Juice—				
Brix	18·70	21·63	20·38	20·57
Purity	87·03	88·87	87·21	87·94
Purity—				
Clarified Juice	86·45	87·18	86·41	86·77
Syrup	86·81	87·32	86·52	86·96
Dilution per cent. First Expressed Juice	23·13	33·03	37·82	32·22
Final Bagasse—				
Pol	2·55	2·89	2·56	2·71
Dry Substance	51·50	52·03	50·78	51·52
Pol Extraction	95·50	94·55	94·36	94·71
Reduced Extraction	95·01	95·23	95·36	95·22
Final Molasses—				
Gallons per ton Cane	4·66	4·85	4·59	4·74
Brix	91·27	90·68	91·00	90·92
Apparent Purity	31·89	34·97	36·34	34·68
True Purity	44·63	43·74	44·46	44·17
Expected Purity	38·4	40·3	42·2	40·5
Reducing Sugars/Ash	1·87	1·33	0·96	1·34
Final Mud—				
Per cent. Cane	3·01	3·51	3·69	3·45
Pol per cent. Mud	3·90	2·80	2·95	3·10
Sugar—				
Pol	98·57	98·80	98·76	98·73
Reducing Sugars	0·37	0·26	0·24	0·28
Ash	0·18	0·23	0·28	0·23
Moisture	0·42	0·30	0·33	0·34
Dilution Indicator	41	34	36	36
Pol Balance—				
Sugar (Recovery)	84·42	85·43	84·45	84·89
Bagasse Loss	4·50	5·45	5·64	5·29
Molasses Loss	6·81	6·36	7·27	6·75
Mud Loss	0·80	0·60	0·74	0·69
Undetermined Loss	3·47	2·16	1·90	2·38
Boiling House Efficiency	94·02	95·12	95·08	94·85
Boiling House Efficiency E.S.G.	93·63	94·77	94·72	94·49
Fuels (as equivalent Bagasse per cent. Cane)—				
Wood	0·55	0·24	0·77	0·47
Coal	0·01	0·00	0·02	0·01
Molasses	0·63	0·00	0·00	0·15
Total added	1·19	0·24	0·79	0·63
Bagasse	24·94	30·65	31·98	29·74
Total Fuel	26·13	30·89	32·77	30·37
Crop Days	1,791	2,247	1,359	5,397

Tons of cane, tons of sugar, tons of cane per ton of sugar and Crop Days include all mills. All other figures exclude C.S.R. and Rocky Point Mills.

Table XIII
Sugar Produced in Districts, 1955 Season, with Peak Allocations

Districts	Tons 94 Net Titre Sugar			Production per cent. Peak
	Produced	Peak	Excess Production over Peak	
Northern	413,853	468,900	−55,047	88·26
Central	509,146	480,000	+29,146	106·07
Southern	212,676	222,000	−9,324	95·80
All Districts	1,135,675	1,170,900	−35,225	96·99

Table XIV
Cane Milled and Sugar Yielded, 1955 Season

Mills	Tons Cane Crushed	* Tons 94 n.t. Sugar made	Tons Cane per ton Sugar	
			1955	1954
Mossman	206,657	25,578	8·079	8·008
Hambledon	259,436	33,748	7·687	7·468
Mulgrave	290,232	36,223	8·012	7·739
Babinda	304,794	33,995	8·966	8·437
Goondi	252,012	31,147	8·091	8·126
Mourilyan	248,692	29,486	8·434	8·137
South Johnstone	344,791	41,995	8·210	8·128
Tully	372,435	45,711	8·148	8·002
Victoria	625,780	84,268	7·426	7·692
Macknade	365,525	51,702	7·070	7·232
Northern District Totals and Averages	3,270,354	413,853	7·902	7·851
Invicta	215,185	28,538	7·540	7·202
Pioneer	314,858	45,689	6·891	6·839
Kalamia	330,456	47,314	6·984	6·731
Inkerman	395,486	58,123	6·804	6·919
Proserpine	333,625	44,335	7·525	7·626
Farleigh	344,853	48,006	7·184	7·263
Racecourse	373,054	51,860	7·193	7·430
Pleystowe	334,848	47,078	7·113	7·464
Marian	322,563	44,143	7·307	7·466
Cattle Creek	160,331	21,960	7·301	7·554
North Eton	201,119	28,654	7·019	7·252
Plane Creek	315,618	43,446	7·265	7·378
Central District Totals and Averages	3,641,996	509,146	7·153	7·217
Fairymead	271,627	33,040	8·221	8·065
Qunaba	145,940	18,156	8·038	7·911
Millaquin	283,429	36,614	7·741	7·833
Bingera	315,210	38,623	8·161	7·864
Gin Gin	104,364	12,158	8·584	8·599
Isis	320,292	40,006	8·006	7·723
Maryborough	102,034	13,071	7·806	7·851
Moreton	135,169	18,119	7·460	7·649
Rocky Point	25,748	2,889	8·912	8·696
Southern District Totals and Averages	1,703,813	212,676	8·011	7·896
All Districts Totals and Averages	8,616,163	1,135,675	7·587	7·581

* Local Sales included.

Table XV

Average Performance of Queensland Mills, excluding C.S.R. and Rocky Point Mills, 1954-1955 Seasons (Arithmetic Averages)

	Northern		Central		Southern		All Districts	
	1954	1955	1954	1955	1954	1955	1954	1955
Cane—								
Pol	13·91	13·61	15·26	15·57	14·10	14·16	14·59	14·68
Fibre	11·02	11·43	13·58	14·01	14·79	14·80	13·36	13·66
Purities—								
First expressed juice	87·27	87·03	89·52	88·87	87·90	87·21	88·50	87·94
Clarified juice	86·59	86·45	88·09	87·18	87·48	86·41	87·56	86·77
Syrup	87·13	86·81	88·46	87·32	87·56	86·52	87·88	86·96
Molasses—								
Gallons per ton cane	4·76	4·66	4·42	4·85	4·09	4·59	4·44	4·74
Apparent purity	32·75	31·89	35·92	34·97	36·35	36·34	35·32	34·68
Recovery overall	85·04	84·42	86·12	85·43	85·29	84·45	85·62	84·89
Recovery overall E.S.G.	84·63	84·08	85·84	85·12	85·03	84·14	85·31	84·58
Recovery on mixed juice	88·95	88·41	90·80	90·35	90·45	89·50	90·27	89·64
Recovery on mixed juice E.S.G.	88·53	88·04	90·49	90·02	90·17	89·17	89·94	89·30
Boiling House efficiency	94·47	94·02	95·27	95·12	95·73	95·08	95·23	94·85
Boiling House efficiency E.S.G.	94·03	93·63	94·95	94·77	95·43	94·72	94·88	94·49
Pol extraction	95·60	95·50	94·85	94·55	94·29	94·36	94·85	94·71
Reduced extraction	94·95	95·01	95·30	95·23	95·33	95·36	95·23	95·22
C.C.S.	12·73	12·42	14·17	14·40	12·94	12·94	13·46	13·49
Coefficient of work	97·44	97·17	97·32	96·87	97·49	96·69	97·40	96·88
Coefficient of work E.S.G.	92·52	92·17	92·39	92·03	92·63	92·08	92·49	92·08

Table XVI

Analysis of Gross Time, 1955 Season, excluding C.S.R. and Rocky Point Mills

	Total Hours	Per Cent. Gross Total Hours	Per Cent. of Available Hours
Crushing Time	72,359·32	65·75	91·06
Lost Time—			
Manufacture	4,559·79	4·14	5·74
Cane Supply	2,542·75	2·31	3·20
Total Available Hours	79,461·86	72·20	100·00
Premeditated and Week-end Stops	30,589·66	27·80	—
Gross Total Hours	110,051·52	100·00	—

Table XVII

Total Crop Days, All Mills, 1946-1955

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Total Crop Days	3,740	4,289	5,708	5,593	6,469	4,089	5,046	5,515	6,110	5,397

Average Crushing Rates, 1946-1955, excluding C.S.R. and Rocky Point Mills (Arithmetic Averages)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Tons cane per hour	59·48	60·55	66·33	68·74	72·35	71·47	78·28	87·15	93·51	97·20

Table XVIII

Fuels Calculated as Equivalent Bagasse Per Cent. Cane, 1946-1955 (Arithmetic Averages)

Year	Wood	Coal, etc.	Molasses	Total Added	Bagasse	Total Fuel
Northern District						
1946	2·287	—	1·088	3·375	22·858	26·233
1947	1·167	0·005	0·913	2·085	22·988	25·073
1948	0·672	—	1·535	2·207	23·063	25·270
1949	0·726	—	1·102	1·828	23·242	25·070
1950	1·050	—	1·878	2·928	24·468	27·396
1951	0·598	—	1·220	1·818	27·169	28·987
1952	0·598	—	0·640	1·238	27·413	28·651
1953	0·562	—	0·111	0·673	25·413	26·086
1954	0·308	0·008	0·434	0·750	23·952	24·702
1955	0·550	0·010	0·627	1·187	24·945	26·132
Central District						
1946	2·730	0·132	0·132	2·994	25·183	28·177
1947	1·487	0·025	0·019	1·531	28·068	29·599
1948	1·617	0·037	0·002	1·656	28·497	30·153
1949	0·899	0·153	0·005	1·057	27·397	28·454
1950	0·763	0·053	0·001	0·817	29·731	30·548
1951	0·564	0·028	—	0·592	32·369	32·961
1952	0·331	0·029	—	0·360	30·507	30·867
1953	0·359	0·018	—	0·377	28·334	28·711
1954	0·182	0·008	—	0·190	29·420	29·610
1955	0·236	0·003	—	0·239	30·651	30·890
Southern District						
1946	5·693	0·697	—	6·390	29·341	35·831
1947	3·785	0·141	—	3·926	30·388	34·314
1948	1·977	0·009	0·012	1·998	31·010	33·008
1949	1·633	0·016	—	1·649	32·138	33·787
1950	0·694	0·060	—	0·754	35·285	36·039
1951	1·362	0·164	—	1·526	34·485	36·011
1952	1·160	0·110	—	1·270	33·614	34·884
1953	0·956	0·078	—	1·034	29·309	30·343
1954	0·845	0·044	—	0·889	31·767	32·656
1955	0·774	0·017	—	0·791	31·980	32·771
All Queensland Districts						
1946	3·516	0·270	0·341	4·127	25·842	29·969
1947	2·238	0·062	0·226	2·526	27·684	30·210
1948	1·519	0·018	0·374	1·911	28·098	30·009
1949	1·122	0·067	0·266	1·455	28·106	29·561
1950	0·808	0·043	0·434	1·285	30·225	31·510
1951	0·818	0·063	0·282	1·163	31·820	32·983
1952	0·648	0·047	0·148	0·843	30·748	31·591
1953	0·589	0·032	0·026	0·647	27·960	28·607
1954	0·414	0·018	0·100	0·532	28·880	29·412
1955	0·474	0·009	0·145	0·628	29·743	30·371

The Courier-Mail Printing Service.